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CONSUMPTION OF TIMBER PRODUCTS in the NORTHERN ROCKY MOUNTAIN REGION

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by

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Forest & Range
Experiment Station
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CONSUMPTION OF TIMBER PRODUCTS IN THE NORTHERN ROCKY MOUNTAIN REGION

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CONSUMPTION OF TIMBER PRODUCTS IN THE NORTHERN ROCKY MOUNTAIN REGION 1/

by

C. N. Whitney and S. Blair Hutchison

FOREWORD

No comprehensive or adequate plans for better management of our remaining forest resources can be prepared without the basic facts which portray the existing situation. The information needed falls logically into two broad classifications: (1) the volume of timber on hand and the producing capacity of the forests and (2) the consumption or use of timber products. This report covers the latter phase. Prepared in connection with the nationwide forest survey, it summarizes the consumption of lumber, fuelwood, fenceposts, and other products in the Northern Rocky Mountain Region - a consumption which, combined with that of other regions, directly influences the amount and nature of forest utilization and, in turn, the size of the forest industry and the area of forest land needed to meet timber requirements. Utilization of wood products, however, has not progressed at a constant rate but has fluctuated. The factors behind such changes are numerous and complex. Nevertheless, wherever possible an attempt has been made to isolate these factors in order better to anticipate future trends.

For the sake of a clear understanding it should be borne in mind that this report deals with the "consumption" of timber products; that is, the amount of lumber, fuelwood, and other products actually used locally. This should not be confused with "drain" which represents the volume of timber products cut. This region does not begin to consume all of its forest production. Almost 40 percent of the green timber cut is felled to meet the needs outside of the region. Fuelwood and most of the minor timber products are largely consumed in or near the locality where

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1/ This report is based in part upon basic data collected by the Division of Forest Products, Northern Rocky Mountain Forest and Range Experiment Station. Assistance in preparation was furnished by the personnel of Works Progress Administration Official Projects OP-01-71 and OP-201-8002.

they are cut. Lumber and cedar poles, on the other hand, are produced in quantities far in excess of local needs and are marketed in other parts of the United States. For that reason, even though a small amount of lumber is shipped in, production greatly exceeds the consumption shown in this report.

While the bulk of the lumber in the United States is consumed in the form of boards, planking, timbers, and other products of the sawmill, directly for construction, a surprisingly large volume is utilized by remanufacturing industries. According to a special canvass the lumber remanufactured during 1933 in the United States was equal to 44 percent of the lumber production for that year.2/ Conceivably, it might be of considerable interest to manufacturers to determine the volume of matches, furniture, boxes, wooden bowls, etc., used in a particular region, but from a forest management standpoint the information most desired is the quantity of lumber entering into the manufacture of these products in various localities. Therefore, in this report the term "consumption" as used with reference to lumber favors the following definition by R. V. Reynolds and A. H. Pierson.3/

> Lumber consumption is merely another term for lumber utilization. Lumber is "consumed" under two conditions: first, when it is utilized directly for construction, without change of form other than planing, as in house building, the laying of ties in track, or the use of timbers for scaffolds, derricks, wharves, bridges, or other heavy construction projects. Second, when it is converted into commodities such as furniture, doors, sash, boxes, boot-or-shoe heels, which can no longer be described in board feet.

In measuring the consumption of timber products in the Northern Rocky Mountain Region, there has been a certain amount of unavoidable duplication. For example, the volume of sash, frames, doors, and general millwork has not been segregated from the estimates of the lumber used in building construction although,

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2/ Lumber Used in Manufacture, 1933. Forest Service, U. S. Department of Agriculture, Washington, D. C.
3/ Lumber Distribution and Consumption for 1936, Forest Service, U. S. Department of Agriculture, Washington, D. C., 1938, Forest Research Project No. 1.

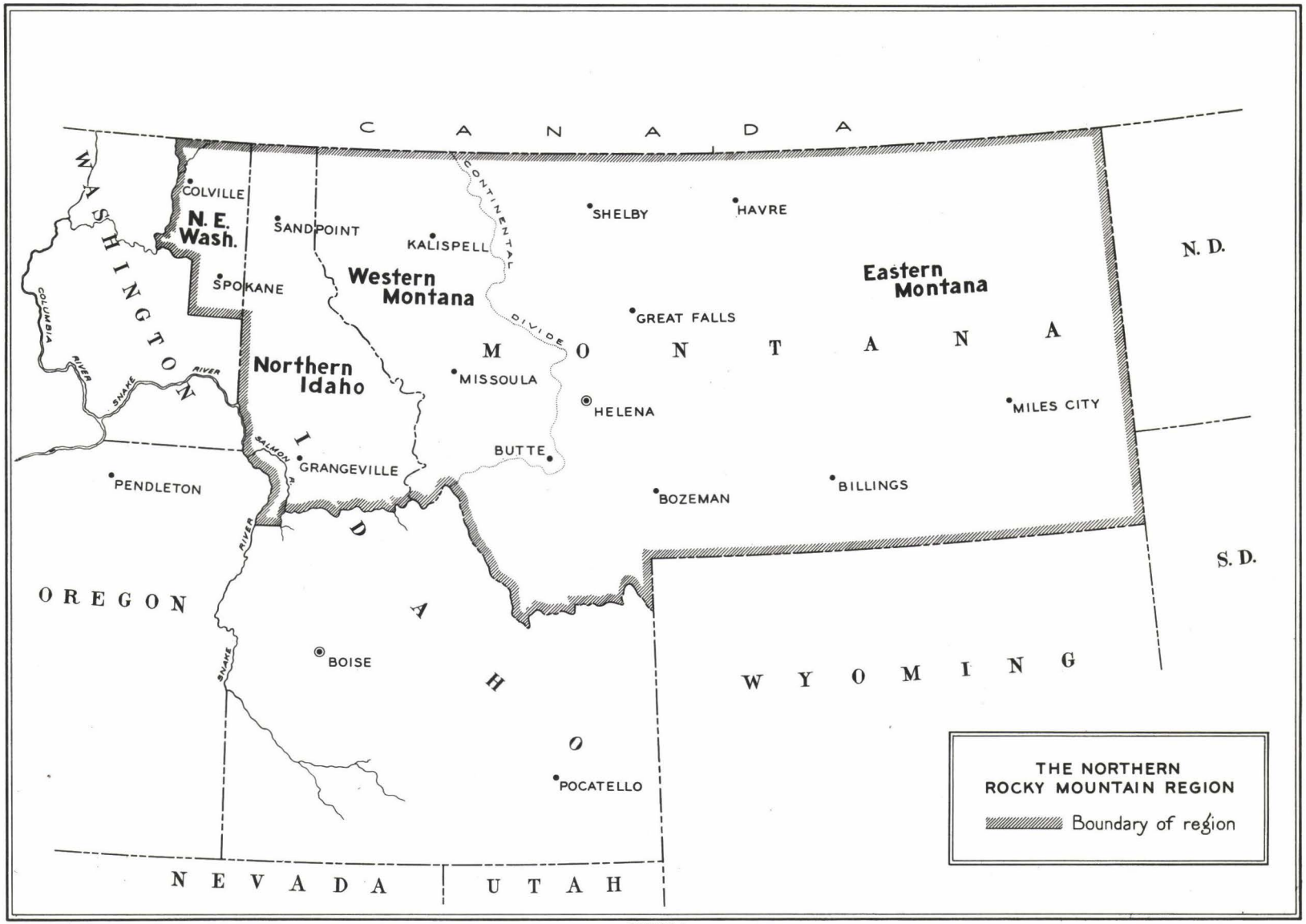
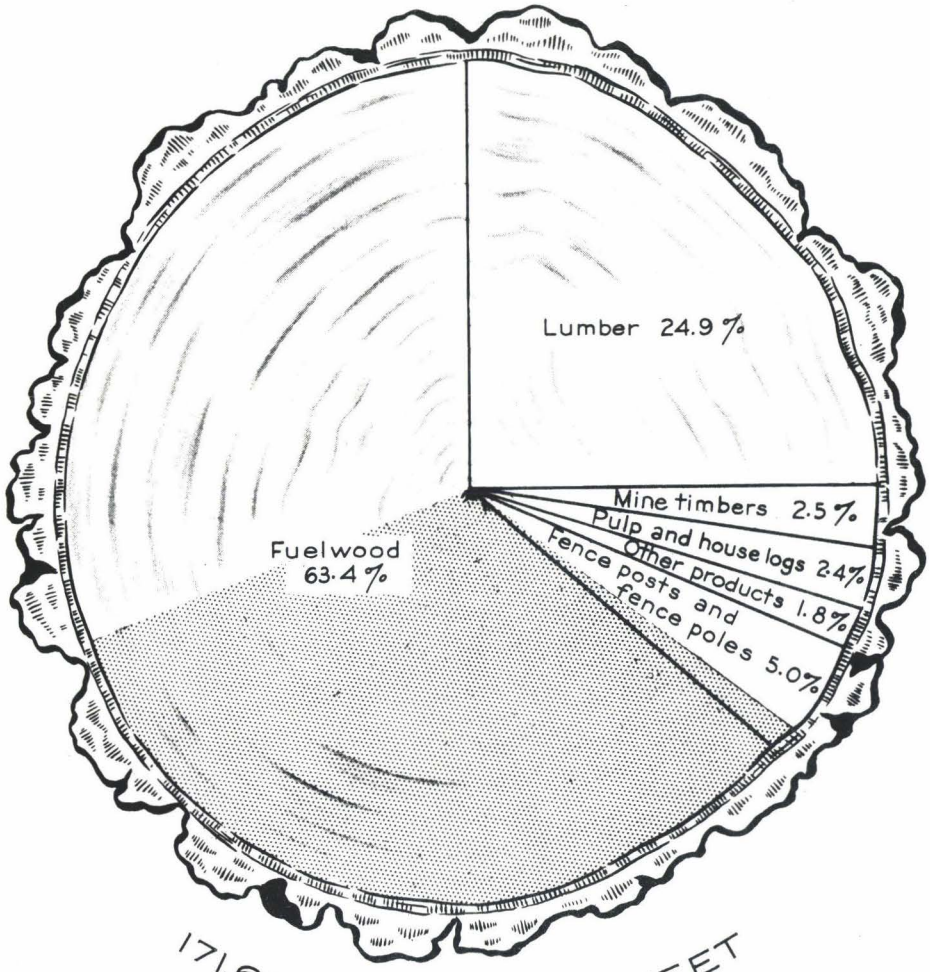

C A N A D A
COLVILLE
N. E. Wash.
SANDPOINT
KALISPELL
CONTINENTAL DIVIDE
SHELBY
HAVRE
N. D.
SPOKANE
Western Montana
Eastern Montana
GREAT FALLS
WASHINGTON
COLUMBIA RIVER
SNAKE RIVER
Northern Idaho
M O N T A N A
MISSOULA
HELENA
MILES CITY
SALMON R.
I
BUTTE
GRANGEVILLE
PENDLETON
BOZEMAN
BILLINGS
S. D.
RIVER
OREGON
I D A H O
BOISE
SNAKE
W Y O M I N G
POCATELLO
N E V A D A
U T A H
THE NORTHERN ROCKY MOUNTAIN REGION
Boundary of region

FIGURE 1

according to the definition, the lumber consumption actually takes place at the remanufacturing plants. The amount of duplication is, however, comparatively small.

The Northern Rocky Mountain Region and the Inland Empire are rather loose terms often applied to different geographic units. For the purpose of the forest survey, however, the former has been defined as including all of Montana; that portion of Idaho north of the Salmon River; and Northeastern Washington, which is made up of Stevens, Pend Oreille, and Spokane Counties. The term "Inland Empire" includes Northeastern Washington, Northern Idaho, and Western Montana, the Continental Divide forming the boundary between Western and Eastern Montana.

AVERAGE ANNUAL CONSUMPTION OF ALL TIMBER PRODUCTS IN THE NORTHERN ROCKY MOUNTAIN REGION



171,667,000 CUBIC FEET

Deadwood, mill slabs, and scraps

FIGURE 2

HIGHLIGHTS OF REPORT

The Northern Rocky Mountain Region is large - 110 million acres. It is thinly populated - 834 thousand people. It is richly endowed with forests - 29 acres of commercial forest land per person. These three factors have combined to make this region one of the heaviest wood-consuming areas in the United States in relation to its population.

The availability of timber has made for a freer use of wood products. Fuelwood is heavily relied upon to furnish heat for homes and in some cases power for industry. Lumber near the forest areas is, in general, cheap and the local population is thus encouraged to use it.

The region stretches almost 700 miles east and west. The transcontinental railroads spanning this distance require enormous quantities of ties and other wood products. The mileage and wood consumption of other communication systems is likewise great, but the population they and the railroads serve in this area is small and therefore the consumption per capita is large.

With an abundant and continuous supply of raw material assured, a number of box factories and other wood-using industries have been attracted to the Inland Empire. Although their products are distributed over the Nation, these operations swell the local lumber consumption.

In order to meet the needs of the Northern Rocky Mountain Region, 172 million cubic feet4/ of timber products are annually consumed. Of this total 63.4 percent or 109 million cubic feet is fuelwood (1,266,000 cords). However, only half of this fuelwood comes from green timber logged primarily for fuel, the other half being slabs, scraps, and deadwood. Lumber,5/ even though it

---

4/ When expressing timber drain the cubic-foot measure includes the entire tree, some of which is lost as waste in woods or mill. The 172 million cubic feet of consumption shown above includes only the actual cubic content of the lumber and other products used. The "cubic foot" affords the only means by which all products can be combined and compared on the same basis. All board-foot figures are in lumber tally except where otherwise indicated.
5/ The term "lumber" as used in this report includes boards, plank, sawed ties, and other sawed products except shingles.

AVERAGE ANNUAL CONSUMPTION OF LUMBER IN THE NORTHERN ROCKY MOUNTAIN REGION

REMANUFACTURE

SASH, FRAMES, DOORS, AND GENERAL MILLWORK

MATCH BLOCKS

BOXES AND CRATES

MISCELLANEOUS

CONSTRUCTION

RAILROADS

FARMS

MINING INDUSTRY

NONFARM CONSTRUCTION

STATE AND COUNTY HIGHWAYS

FEDERAL AGENCIES

PUBLIC UTILITIES

EACH CAR AND ENGINE REPRESENTS
10 MILLION BOARD FEET LUMBER TALLY

The total of these items amounts to 514 million board feet lumber tally which is equivalent to 416 million board feet (log scale) of standing timber

FIGURE 3

is the principal commodity cut from the forests of this region, ranks second in the local consumption. The average annual consumption of lumber is estimated to be 43 million cubic feet (514 million board feet). In 1936, probably a typical year, approximately three-fifths of the local lumber production was marketed outside the boundaries of this region.

Eleven other timber products are consumed in large quantities in this region. They are: fenceposts, round mine timbers, pulp logs, converter poles, poles, piling, pole-stubs, shingles, house logs, hewed ties, and fence poles. Although commercially valuable, these products represent only approximately 12 percent of the wood volume consumed (20 million cubic feet). A detailed record of timber products consumption is contained in table A of the appendix.

It has been possible to classify lumber utilization in the region more or less by type of consumption, as is shown in figure 3 (see also table B in appendix). Approximately 46 percent (235 million board feet lumber tally) enters local remanufacturing plants, the remainder being used for construction of various types. Ranking next to the remanufacturing industries as a group, the railroads are the second largest consumers of sawed products, annually using over 83 million board feet of lumber, principally in the form of ties and timbers. The farm use is slightly smaller, amounting to approximately 74 million board feet; and the mining industry is next, annually requiring around 59 million board feet. These lumber consumption data are briefly presented in figure 3 along with the other less important items contributing to the regional total of 514 million board feet. The factors affecting each type of consumption and the trends are discussed in detail in the following chapters.

A more detailed summary of the timber products consumption in the Northern Rocky Mountain Region is contained in tables A, B, and C of the appendix.

WHAT THE CUBIC FOOT MEANS IN SOME OF THE MORE COMMON UNITS OF MEASURE.
100 cubic feet equal approximately:
220 linear feet mine timbers
1,200 board feet of lumber
1.2 cords of fuelwood
100 fenceposts
8 poles

PER CAPITA CONSUMPTION

Per capita consumption figures have long been used to show trends and compare the needs of the different sections of the country for timber products. Within a region, as shown in the following table, the total volume of wood used per person varies considerably from place to place:

Table 1. - Average annual consumption of all timber products

Subregion	Consumption	
	Total	Per capita
	Thousand cubic feet	Cubic feet
Eastern Montana	51,812	136
Western Montana	38,340	243
Northern Idaho	40,473	337
Northeastern Washington	41,042	233
Entire region	171,667	206

The nearness to a timber supply exerts a considerable influence upon the per capita consumption, particularly in the case of fuelwood. Yet a great share of the difference between the subregions in per capita consumption is attributable to variations in population density and the nature of local industries. Table 2 shows the total and per capita lumber consumption for the four regional subdivisions. The importance of population density and nature of industries as factors is evident from an analysis of the low and high consumption rates shown in this table for Eastern Montana and Northeastern Washington, respectively. Of the 1,097 board feet consumed per capita in Northeastern Washington, 907 feet are used by the remanufacturing industries whereas the volume

Table 2. - Average annual lumber consumption, lumber tally

Subregion	Consumption	
	Total	Per capita
	Thousand board feet	Board feet
Eastern Montana	118,451	312
Western Montana	100,073	635
Northern Idaho	102,032	851
Northeastern Washington	193,232	1,097
Entire region	513,788	616

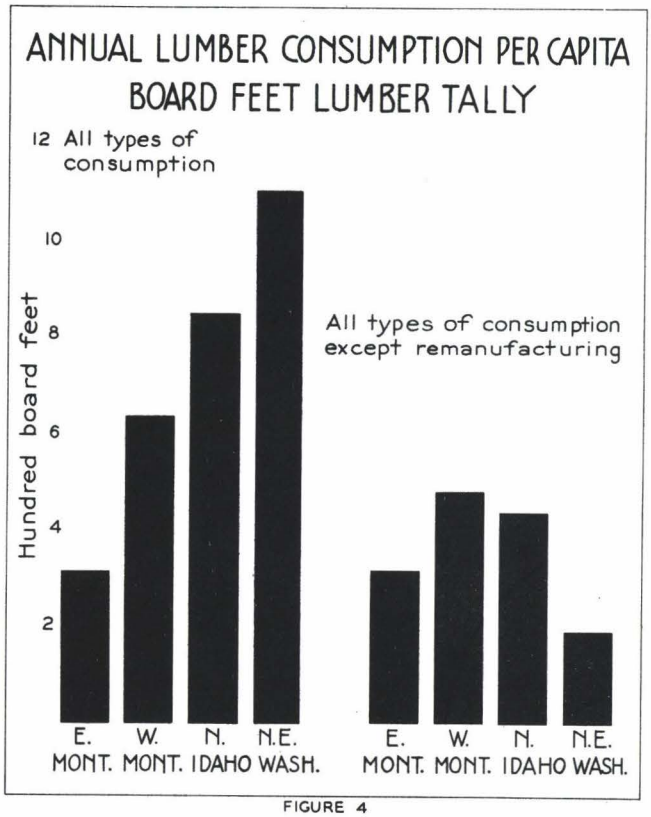


FIGURE 4

remanufactured in Eastern Montana is negligible. Thus, excluding remanufacturing industries, the per capita consumption of lumber in Eastern Montana is 312 board feet compared with 190 board feet in Northeastern Washington. This relationship is one which would be expected, since Eastern Montana has a larger proportion of rural population and great distances of railroads, highways, power, and communication systems serving sparsely settled country.

Per capita lumber consumption by kind of use or user is shown in detail in table C of the appendix.

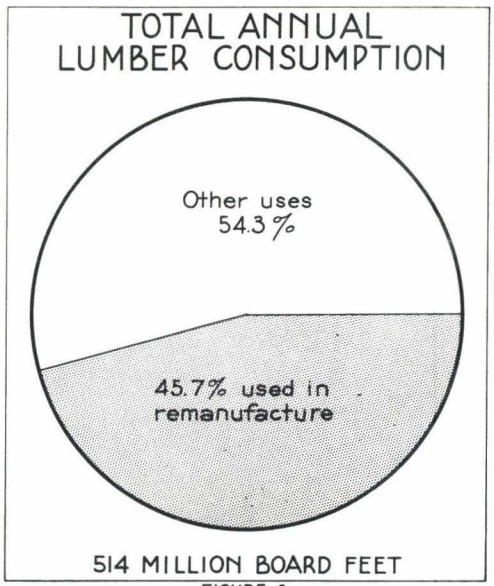


FIGURE 5

CONSUMPTION OF LUMBER BY REMANUFACTURING INDUSTRIES

Nearly 235 million board feet of lumber are remanufactured annually into secondary wood products in this region. This is about one-fifth of the average annual lumber production (1925-1937). Sash, frame, door, and millwork plants are estimated to consume 110 million board feet annually in supplying 5 or 6 percent of the Nation's requirements for these products. Approximately 63 million board feet of white pine plank are converted into match blocks each year and 58 million feet of several different species enter into box and crate manufacture. These three industries account for 98.6 percent of the 235 million board feet of lumber remanufactured. Other items produced to a less extent include caskets, auto bodies, furniture, fixtures, and boats.

As the largest city in the region and practically the only one considered as industrial, Spokane contains the majority of the plants, being the match block capital of the United States and an important producer of the major articles listed above. In 1938 thirty-two remanufacturing plants were operating within the metropolitan area of this city. Other remanufacturing plants are scattered throughout the Inland Empire, but are unimportant in Eastern Montana.

Table 3. - Lumber used annually by remanufacturing industries - average 1928 and 1933

Item	Eastern Montana	Western Montana	Northern Idaho	Northeast Washington	Total
	Thousand board feet - lumber tally				
Sash, frames, doors, and gen. millwork	48	18,328	34,842	56,807	110,025
Match blocks				63,148	63,148
Boxes and crates		4,831	14,898	38,663	58,392
Caskets				819	819
Miscellaneous		2,034	50	293	2,377
Total	48	25,193	49,790	159,730	234,761

The importance of remanufacturing in each of the regional subdivisions is shown in the preceding table based on cooperative studies of the U. S. Bureau of Census and the Forest Service.6/

During recent years the remanufacturing industries have experienced violent ups and downs. In 1928, 191 million board feet of lumber were fabricated into sash, frames, doors, and general millwork in this region. The collapse of the building industry following 1929 resulted in a reduction of the lumber manufactured into these products to 29 million board feet in 1933. The box industry suffered less severely during the same period, the amount of lumber used for this purpose shrinking from 75 million to 42 million board feet. With a single exception the decline was shared by the other products. The output of match blocks is said to have increased.

No attempt has been made to estimate the number of sash, frames, doors, and pieces of general millwork sold within the region. It is known that the bulk of the material, however, is shipped to outside markets. In 1928 and 1933, an average of 5.7 percent of the Nation's supply of these products was produced here; whereas, according to the 1930 census, less than one percent of the national population resides in this region.

6/ The only available and recent records of lumber used in manufacture were collected by these agencies in 1928 and 1933. The first of the surveys obtained a cross section of the industries during a period of prosperity and the second a picture at the low tide of the depression. While present conditions are not as good as in 1928, neither are they as bad as in 1933. However, it is believed that, for the region as a whole, an average of these two years may be representative of the period 1925-1937, inclusive. National figures on building construction and box consumption for that period indicate this to be a fair assumption. There is no absolute definition of remanufacturing. In the 1928 canvass all planing mill products were included, and in 1933 the only planing mill item recorded was flooring. Due to the borderline nature of these products, including flooring, they are not considered as remanufactured goods in this report. As match blocks were not included in the 1933 survey, the 1928 figures were used in table 3 and are probably not representative, being low for Northeastern Washington, besides not showing any production for Northern Idaho. Approximately 93 million board feet of match plank were produced by the white pine mills in 1936, most of this plank being chopped into blocks at the seven block factories in Idaho and Washington.

Match manufacture is a process of two principal steps. The lumber, which comes from the sawmill as two or two-and-one-half inch plank, is first sawed and chopped into blocks which include only the straight-grain portions of the plank. The blocks measure the length of a match with the grain and are ready for the second step which is the manufacture into matches. The matches are made in other parts of the United States, the blocks alone being produced here. At the present time there are five match block factories in Spokane, one at Orofino, Idaho, and one at Bovill, Idaho.

Between 1 and 2 percent of the box and crate shooks consumed in the United States are produced in this region and these likewise are principally shipped elsewhere. It is estimated that 825,000 wooden boxes and crates, representing 3.6 million board feet of lumber, are required annually to handle the commercial crop of fruits and vegetables grown in the region. The truck gardens and fruit farms are believed to represent the only important local market for wooden containers, although the Forest Service uses a number of such boxes in packing fire fighters' rations. In 1938 seventy thousand board feet of box shooks were used for the latter purpose.

Table 4. - Lumber required to manufacture boxes and crates used annually in the Northern Rocky Mountain Region

	Thousand board feet - lumber tally
Western Montana	1,372
Northern Idaho	607
Northeastern Washington	1,708
Total	3,687

Table D of the appendix presents the tabulations from the 1928 and 1933 surveys of the remanufacturing industries.

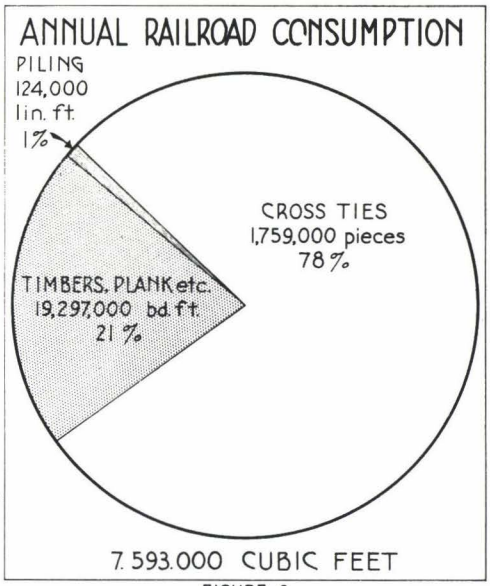


FIGURE 6

CONSUMPTION OF TIES, SAWED TIMBERS, BOARDS, PLANK, AND PILING BY THE RAILROADS

Railroads are a major industry in the Northern Rocky Mountain Region. They utilize 16 percent of the total lumber consumption or 30 percent of the lumber not consumed by the remanufacturing industries. Their lumber requirements (including sawed ties) exceed those of any other industry except remanufacturing, and in addition they annually use large quantities of poles, piling, fenceposts, and hewed ties. It is estimated that the physical plant of the 16 roads operating in this region contains more than one billion board feet of timber products in actual service.

In 9,271 miles of maintained track there are 27 million crossties in use, hewed and sawed. Replacement of these ties has been taking place at the rate of 1,759,000 annually or complete renewal once every 15 years. Nineteen million board feet of boards, plank, and sawed timbers and 124,000 linear feet of piling are also consumed each year.7/

The total annual consumption of crossties, boards, plank, sawed timbers, and piling for each of the regional subdivisions is shown in the following table:

7/ Pole consumption amounting to 9,000 pieces annually, and fencepost consumption, which is likewise large, are included in other sections of this report.

Table 5. - Annual average railroad consumption of crossties, boards, plank, sawed timbers, and piling

Subregion	Ties	Boards, plank, sawed timbers	Piling
	M pcs.	M board feet lumber tally	M linear feet
Eastern Montana	976	9,746	65
Western Montana	320	3,579	23
Northern Idaho	278	2,608	21
Northeastern Washington	185	3,364	15
Total	1,759	19,297	124

The network of track tapping the resources of this region is operated and maintained by 16 concerns of more or less separate identity. However, 87 percent or 8,079 miles of the total 9,271 miles of track is operated by the three major rail systems traversing the region, the Chicago Milwaukee St. Paul and Pacific Railroad Company, the Great Northern Railway Company, and the Northern Pacific Railway Company. Although the other roads are mainly short independent lines, several are branches of other major railway systems. In comparing the average annual requirements for crossties, boards, plank, sawed timbers, and piling per mile of track, significant differences may be noted between the three large systems as a group and the other smaller lines. The consumption of crossties has been at a lower rate for these major roads, but on the other hand the amount of sawed timbers and lumber has been more than twice as great per mile of track for these large lines as for the others. This is shown in table 6.

Table 6. - Average annual consumption of crossties, boards, plank, sawed timbers, and piling per mile of maintained track

Item	Large railroads	Smaller railroads	All railroads
Crossties (pieces)	182	245	190
Boards, plank, and sawed timbers 1/ (board foot lumber tally)	2,237	1,027	2,081
Piling (linear feet)	14	9	13

1/ Including switch and bridge ties.

In the case of crossties, at least, these differences are readily explained, for the principal railroads, with vast stretches of track to maintain, have made considerable effort to extend the service life of the ties and thereby keep this important item as small as possible in the maintenance program. This has been accomplished to a certain extent through the use of larger tie plates and by other purely mechanical improvements, but the principal reason for the longer average life now realized from the crossties of these roads has been the practice of treating the ties with preservatives to retard deterioration. No data are available for the track within the region showing the percentage of treated crossties now used by each of these railroads; however, the following figures for the entire systems indicate that the treated product predominates in the annual renewals:

Percent of crossties treated, 1937

Milwaukee Railroad	61.1 percent
Great Northern Railway	94.2 percent
Northern Pacific Railway	96.6 percent

The longer service obtained because of the increased use of treated crossties is said to have first noticeably reduced the requirements in the early 1920's. This was followed by a distinct downward trend which became particularly marked in the several years following 1929. A good share of this post-'29 decline, though, may be attributed to the general depression which made it necessary to pare replacements to the bone. An improvement in rail traffic was accompanied by an increase of renewals during 1936 and 1937. In 1927, 1928, and 1929 the Milwaukee, Great Northern, and Northern Pacific Railroads are estimated to have set an average of 227 new crossties per mile annually in this region. By 1933, 1934, and 1935 the yearly replacements had declined to 133 ties per mile, increasing again to 160 in 1936 and 1937.

From the data presented in table 6 the annual replacements of the three large roads as a group are indicated to have been at the rate of approximately 182 crossties per mile per year in the Northern Rocky Mountain Region which, assuming that the crossties will average about 2,900 to the mile of track, indicates a service life per tie of almost 16 years. In isolated instances treated crossties have given 40 years or more of service; however, under all conditions in this region a reasonable average life expectancy for treated ties would probably be somewhere between 20 and 25 years, which is still substantially better than the 6 to 12 years' service received from the bulk of the untreated crossties. It is apparent that these roads have since 1930 deferred renewals

which would have been taken care of under a normal program. With the return of more prosperous times and the greater wear and tear of heavier traffic, it is likely that the renewals will reach a point sufficiently high to overcome this deferred maintenance. In view of these several independent variables all that can be said conclusively is that while the annual tie replacements of the large roads may be expected eventually to stabilize at a somewhat lower figure, there seems to be no sound basis for assuming that their consumption for the coming few years will be substantially more or less than 182 crossties per mile of track, or that the average for all roads will differ greatly from 190.

The reader interested in a more detailed summary of railroad consumption data should turn to table E of the appendix.

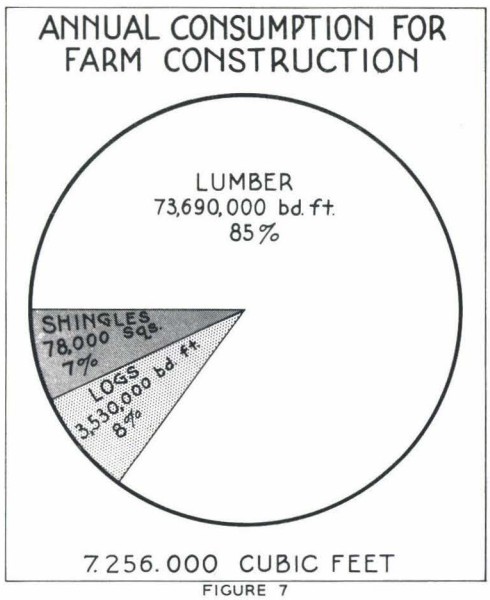


FIGURE 7

CONSUMPTION OF LUMBER, SHINGLES, AND BUILDING LOGS ON FARMS

Farms rank third in consumption of lumber in the Northern Rocky Mountain Region. New buildings, repairs, gates, stock shelters, and other uses on the farms annually require 74 million board feet of lumber - 14.4 percent of the total used within the region. Used also for construction purposes are 78,000 squares of shingles, and slightly more than 3.5 million board feet of building logs, bringing the total consumption of these three products to 7 million cubic feet.

Table 7. - Average annual farm consumption of lumber, shingles, and building logs, 1925-1937

Subregion	Lumber	Shingles	House logs
	Thousand board feet 1/	Thousand squares 2/	Thousand board feet 3/
Eastern Montana	39,360	35	2,060
Western Montana	10,370	13	440
Northern Idaho	13,730	17	590
Northeastern Washington	10,230	13	440
Total	73,690	78	3,530

1/ Lumber tally.
2/ A square of shingles is approximately 800 pieces or a number sufficient to shingle 100 square feet of surface.
3/ Log scale.

The volume of lumber, shingles, and building logs used by the farmer varies from year to year, place to place, and from farm to farm depending upon a multitude of factors, some of which are obvious and others less easy to isolate. Yet, when the

region is divided into two parts, Eastern Montana and the Inland Empire, there appears to be a definite relation between size of farm and the consumption of the three products over a period of time. This is shown in figure 8. In the Inland Empire 40-acre farms in the decade from 1925 through 1934 each used 950 board feet of lumber, shingles, and logs annually, 160-acre farms - 1,550 board feet, and 640-acre farms - 3,300 board feet. These figures are all in lumber tally. The range is much smaller for Eastern Montana: 500 board feet for 40-acre establishments, 800 board feet for 160-acre farms, and 1,100 board feet for 640-acre farms.

The strikingly large differences in use of wood on Eastern Montana and Inland Empire farms of the same size can be attributed to three facts: (1) the need for storage space is generally less in Eastern Montana due to somewhat different types of farming. (2) the agricultural industry in Eastern Montana is at a lower economic level, and (3) lumber is cheaper in the heavily forested Inland Empire.

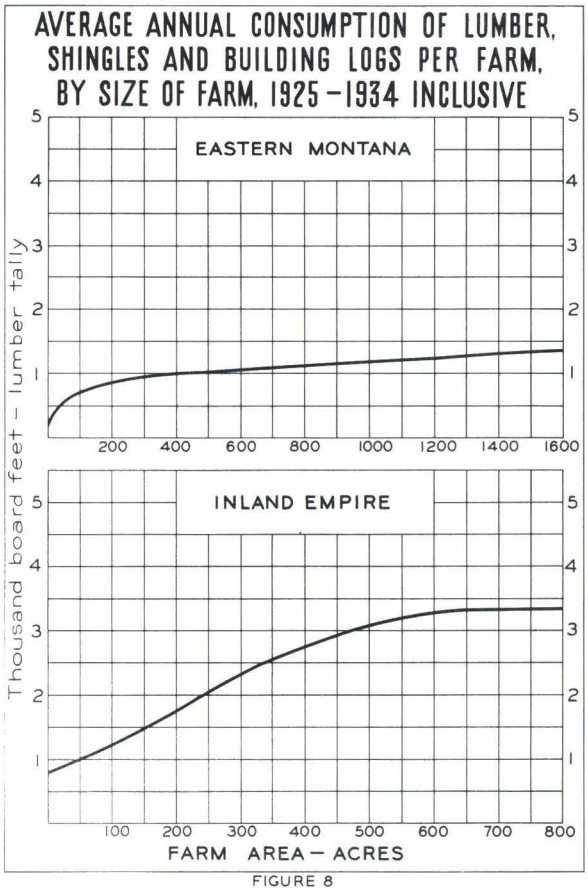


FIGURE 8

While size for size the difference in wood consumption between Eastern Montana and Inland Empire farms is great, the consumption averages for all farms in the two areas differ less because the farms are so much larger in Eastern Montana. The average farm in Eastern Montana is estimated to have utilized 1,102 board feet of lumber, shingles, and logs each year during 1925-1934. In the Inland Empire the average was 1,715 board feet. In 1930 the average operating unit in Eastern Montana was 1,026 acres as compared with 281 acres in the Inland Empire.

Although a more or less temporary situation, the reuse of old lumber

offers an interesting angle to the wood requirements problem in Eastern Montana. A great deal of the lumber contained in buildings on abandoned farms has been salvaged and some used for construction. To a certain extent the availability of this old material cuts down the requirements for the new, but on the other hand, this cheap supply has enabled many farmers to undertake construction which they otherwise could not have afforded. Farms sampled in Eastern Montana were found to use an average of 105 board feet of old lumber yearly, which is, of course, not included in preceding consumption figures.

It is particularly significant that the utilization of lumber, shingles, and building logs for maintenance and miscellaneous use does not vary materially between the two regional subdivisions. Of the new building material for all purposes 450 board feet per farm went for maintenance and miscellaneous use in Eastern Montana and approximately 400 board feet in the Inland Empire. Both these volumes are undoubtedly below the desirable figure, representing more nearly the minimum without which successful farm operation would be impossible. A number of farms canvassed had used little or no lumber or other material for maintenance for several years. In a large percentage of the cases the condition of the physical improvements gave evidence that this was not due to an absence of the necessity but rather to the lack of the wherewithal.

Development of Agriculture

Extensive farm development in the Northern Rocky Mountain Region has been comparatively recent, taking place largely since 1890. The trend of development has naturally been reflected in lumber consumption, the needs for building material being exceptionally high during the period of heavy settlement and falling off somewhat as the basic building requirements were met. Farm consumption has not yet become stabilized.

For a complete understanding of past lumber consumption on farms, it is necessary to review briefly the developments since 1890 and the trend pattern which they have formed. In the year 1890 there were, in round numbers, about 4,000 farms east of the Continental Divide in Montana. By 1900 the farms had increased to 10,000 and in 1920 there were 51,000 farms, an all-time high for census years. This period, up to 1920, was marked by a great swing away from grazing to grain farming as the settlers, deceived by a short cycle of relatively moist years and an excellent market for their products, broke the sod on thousands of

acres of this semiarid country, which now are known to be submarginal for any use except grazing.

Following 1920 came the inevitable end of this ideal combination of conditions. Recurring droughts, too small farm units, and decline of farm prices combined to throw Eastern Montana agriculture into reverse gear. By 1925 the farm units had decreased in number to less than 41,000, remaining approximately at that figure until 1930. A subsequent increase to 42,000 farms in 1935 does not necessarily indicate the end of the downward trend. The upswing is said to have been due to a temporary "back to the land" movement of urban families, caused by the depression.

The ages of the buildings now standing on the sample farms, as is shown in figure 9, reflect the course of this expansion. Seventy-three percent of the houses were constructed during the period 1906 to 1925, inclusive. The construction of barns and sheds likewise principally took place in this period, although the building of barns and sheds since that period has held up better than house construction. Figure 9 does not take into account the buildings on the abandoned farms, which were built during the boom period, but which may not be within farm units now, or which have been salvaged for fuel or lumber. Actually, some of the buildings put up on the sample farms during the last decade were built of such salvaged lumber, making the consumption of new lumber since 1925 somewhat lower than would otherwise be the case.

Agricultural expansion began somewhat sooner in the Inland Empire as a whole, the value of the choicer areas in this more favored portion of the region being early apparent. In 1900 there were 14,000 farms in the Inland Empire. The several following decennial censuses show an increase to 21,000 in 1910 and 25,000 in 1920. In the next decade the trend was reversed, however, as the number of farm units had declined to 23,000 at the time of the 1930 census. This reverse was probably more or less a normal reaction in the settlement of new territory. It certainly was much less of a decline than in Eastern Montana, as it amounted to approximately 8 percent as compared with 20 percent in that district. Moreover, immigration subsequent to 1930 has once again started a trend of expansion. The settlement of drought-region farmers in this locality increased the number of farms to 28,000, approximately, in 1935, and it is said that a considerable number of settlers have come in since that time. The desirability of such a large increase and the permanence of the majority of these new farms remain to be seen.

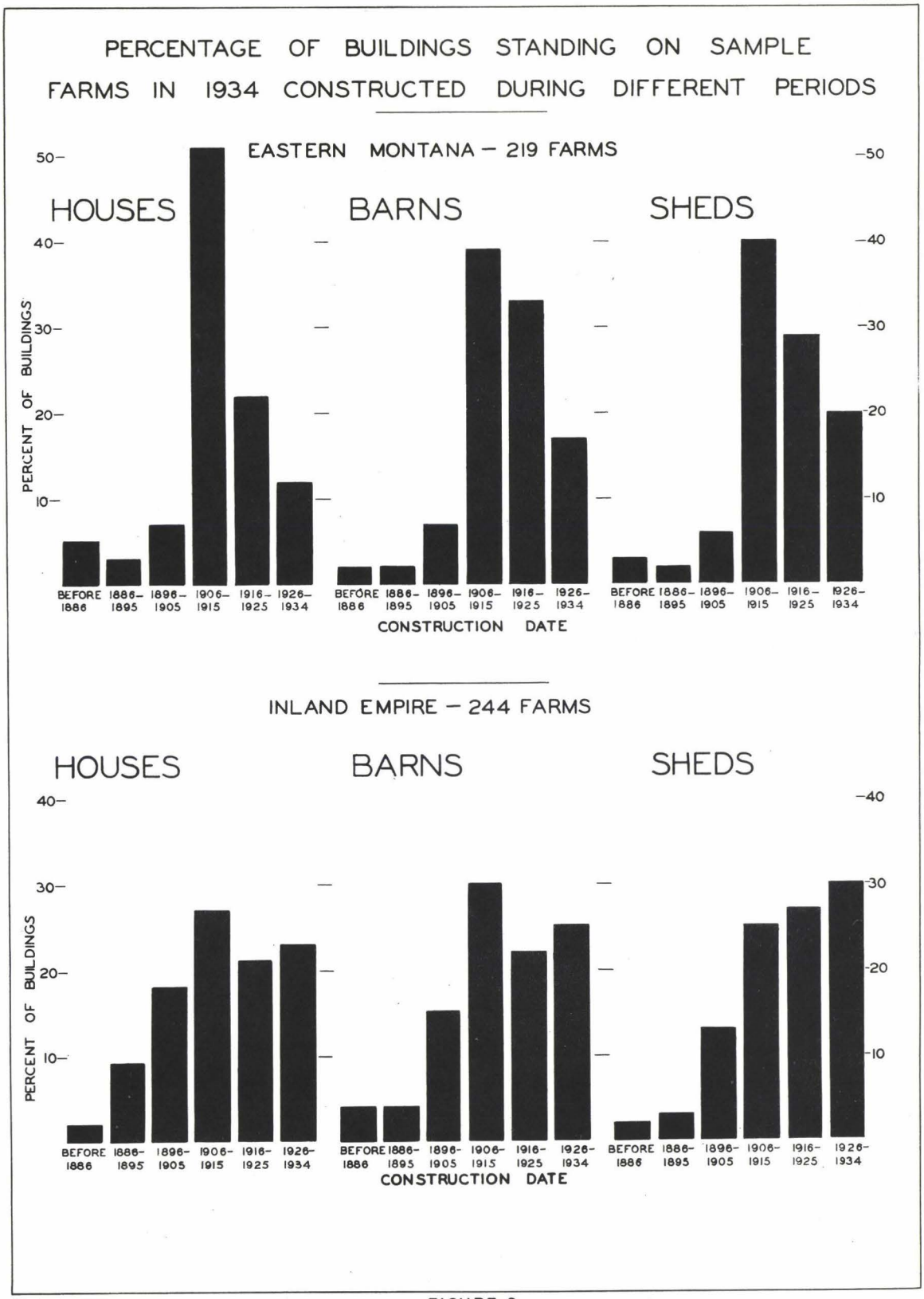

PERCENTAGE OF BUILDINGS STANDING ON SAMPLE FARMS IN 1934 CONSTRUCTED DURING DIFFERENT PERIODS
EASTERN MONTANA – 219 FARMS
HOUSES
BARNS
SHEDS
PERCENT OF BUILDINGS
50
40
30
20
10
BEFORE 1886
1886–1895
1896–1905
1906–1915
1916–1925
1926–1934
CONSTRUCTION DATE
INLAND EMPIRE – 244 FARMS
HOUSES
BARNS
SHEDS
PERCENT OF BUILDINGS
40
30
20
10
BEFORE 1886
1886–1895
1896–1905
1906–1915
1916–1925
1926–1934
CONSTRUCTION DATE

FIGURE 9

A particularly striking difference between the age pattern of the farm buildings in the Inland Empire and Eastern Montana may be noted in figure 9. This is largely explained by two facts: (1) the settlement west of the Continental Divide has been more gradual and spread over a longer period, (2) this western section has not suffered the same depressing economic conditions as has Eastern Montana.

Future Consumption Trends

The low construction and maintenance standards of past years on many of the farms may be expected to keep future replacements high. Poorly constructed buildings, while requiring just as much lumber as the better class structures, have a considerably shorter life expectancy, thus raising the lumber needs per farm over a period of time.

The inherent weaknesses of prediction are increased in the case of farm building by the fact that assumptions must be made as to replacement age of the average building. So completely a question of "ifs," any age assumptions are but one step better than guesses. Such data as are available indicate, however, that 45 years is probably a reasonable life expectancy for farm houses and 35 years for barns and sheds. On this basis about 78 percent of the buildings on the occupied Eastern Montana farms will have ended their period of usefulness and will need replacing during the quarter century from 1935 to 1959, inclusive. This is at the rate of approximately 3.1 percent yearly. Eighteen percent of the buildings standing in 1934 were built during the preceding nine years or an average of about 2 percent yearly (figure 9). Thus, if the age assumptions are valid and present standards are to be maintained, it is apparent that replacement of buildings on existing Eastern Montana farms during the coming years must be stepped up considerably. In the Inland Empire, obsolescence would necessitate the replacement of about 69 percent of the buildings in 25 years, or 2.8 percent annually, whereas new building in the period 1926 to 1934 has been somewhat higher, 3.1 percent each year.

A primary factor affecting future requirements is the extent to which the number of farms will increase or decrease during the coming years. The abandonment of dry-land farms will probably continue in Eastern Montana. In Petroleum County, for example, where the number of farm units increased from 363 in 1930 to 373 in 1935, the number is reported to have fallen off to 250

by December 1937.8/ On the other hand, it is quite possible that the development of irrigation projects may offset at least some of this departure from dry-land areas. The Government-sponsored effort at farm reorganization will ultimately affect wood consumption by the Eastern Montana farm industry. This program includes Government purchase of submarginal land, assistance to remaining farmers in acquiring self-supporting units, and more satisfactory credit facilities. With the individual farmer in a sounder economic position it is to be expected that ranch requirements for wood products will be boosted. In the Inland Empire it seems likely that the number of farms will remain greater than in 1930, although some of the submarginal ones will pass out of the picture. At the present time, however, many of the newer farms are not consuming much building material, because of the financial difficulties of the operators of these establishments.

Despite these many conflicting factors, it seems reasonable to conclude that, although the farming of this region has not become stabilized as yet, the lumber, shingle, and building-log requirements are likely to continue somewhere near the 1925-1934 levels for the next five to ten years.

Additional information concerning farm consumption is contained in tables F and G of the appendix.

8/ An Inventory of the Range Resources in Petroleum County, Montana, by the Cooperative Western Range Survey.

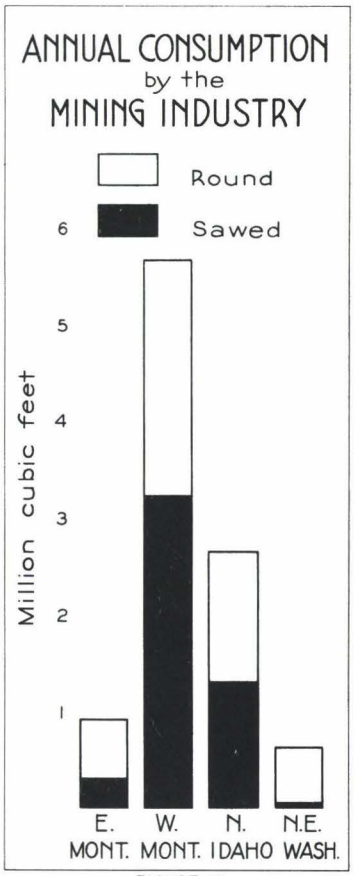


FIGURE 10

CONSUMPTION OF TIMBER PRODUCTS BY THE MINING INDUSTRY

Since time immemorial man has bolstered his tunneling in the earth with supports of wood. In this region, partly owing to the availability and utility of timber products, the great mining industry has sunk its shafts a mile into the earth in the search for mineral wealth. Approximately 10 million cubic feet of round and squared timbers, lagging, ties, boards, plank, converter poles, and logs are annually consumed in the processes of the mining industry. The timber needs of the mining industry vary widely, ranging upwards from the negligible consumption by the placer mines and the open-pit coal mines. The extent of the timber requirements depends upon the type of operation, the nature of the ground, and other factors. There are at least five distinct branches to the mineral industry in the Northern Rocky Mountain Region: (1) metal mining in Montana, (2) metal mining in Northern Idaho, (3) metal mining in Northeastern Washington, (4) nonmetal mining in Northeastern Washington, and (5) coal mining in Eastern Montana. The total wood consumption of these five phases of the industry is shown in table 8.

Table 8. - Average annual consumption by the mining industry of wood for construction purposes 1/

Subregion	Lumber	Round and hewed products
	M board feet lumber tally	M cubic feet
Eastern Montana	3,744	627
Western Montana	38,821	2,447
Northern Idaho	15,760	1,331
Northeastern Washington	688	577
Total	59,013	4,982

1/ Includes all timber products except fuelwood.

PRODUCTION OF THE MAJOR MINING DISTRICTS IN THE NORTHERN ROCKY MOUNTAIN REGION

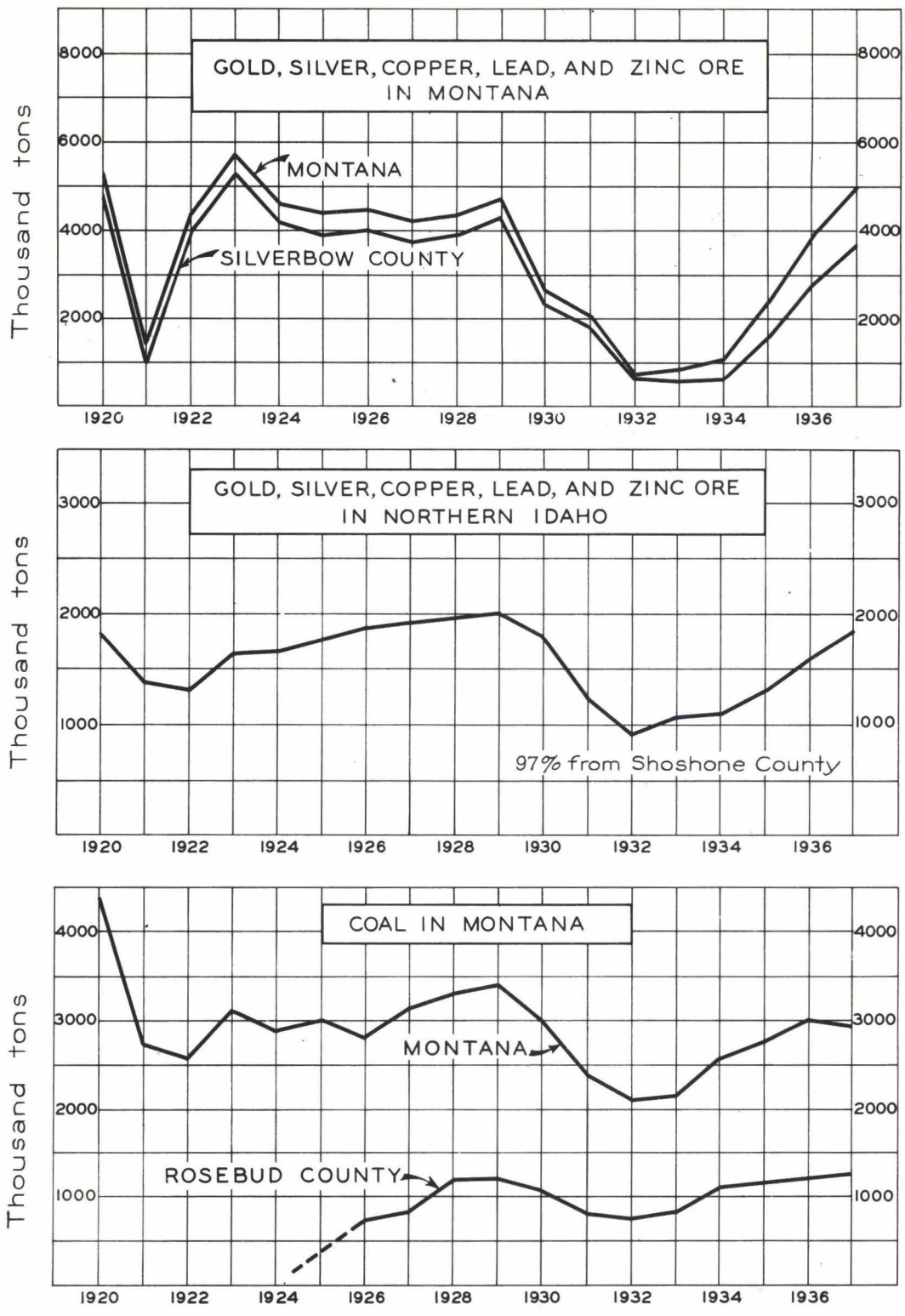


FIGURE 11

Montana Metal Mines

Montana is one of the principal sources of nonferrous metals in the United States, having produced almost 2.8 billion dollars worth of copper, silver, zinc, gold, and lead since 1862. Copper has been the leading metal of this State, its value exceeding that of all other metals combined. Nearly all of it has been taken from the rich lode mines in the Butte district. Since 1925, only 17 percent of the ore mined in Montana has come from outside this area.

Past consumption - Figure 11 shows the marked fluctuations in mineral production which have taken place in the past two decades. As there is a more or less stable relationship between the tonnage of ore produced and the volume of forest products consumed in the mines, there has been a similar variation in timber consumption. From 1925 to 1937, inclusive, it is estimated that the lode mines annually consumed an average of 38 million board feet (lumber tally) of sawed products and 12 million board feet (log scale) of round timbers (excluding smelting operations). From the standpoint of their requirements these mines may be divided into two classes, (1) the Silverbow County copper mines and (2) the metal mines in other counties. Records based on 86 percent of the Silverbow County ore production from 1925 to 1937 indicate a consumption at the mines of 14.10 board feet of sawed material per ton of ore brought to the surface. This sawed material has consisted mainly of lagging and timbers used below ground. The round timbers used during the same period ran considerably less, amounting to 1.66 linear feet per ton (4.15 board feet log scale per ton). The other metal mines have consumed only 3.0 board feet of sawed material (lumber tally) and 2.14 linear feet of round products per ton of ore brought to the surface.

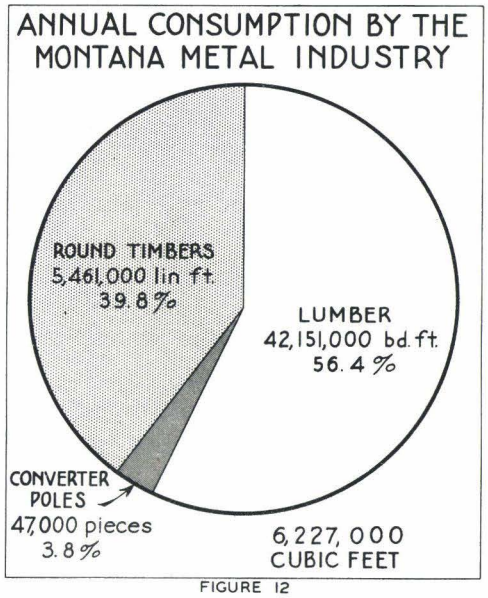


FIGURE 12

The forest products utilized in the concentrating and smelting plants are relatively less important from the standpoint of volume. The consumption of lumber in the three large reduction works at

Anaconda, Great Falls, and East Helena, plus the minor use at mine concentrators, has amounted to less than 4 million board feet (lumber tally) annually from 1925 to 1937, inclusive. Approximately 47 thousand converter poles are used yearly. The fuelwood consumption, which is included in another section of this report, amounts to approximately 800 cords which is used in the lime plant and for warming the converter spouts. The annual consumption of all products except fuelwood is shown in figure 12.

Future needs - The requirements of the Butte mines, the hub of Montana's mining industry, quite largely govern the future timber product consumption. Records collected in this district since 1917 indicate no material change in the wood requirements per ton, although there have been minor shifts in practice affecting the use of forest products. There has been a gradual supplanting of pole lagging by low grade plank lagging, and the former has ceased to be a significant item since 1931. However, as this type of lagging made up only one-half of one percent of the round timbers used in the mines from 1925 to 1937, the change has had little effect upon the board-foot-per-ton ratios.

Owing to the close correlation between ore tonnage and wood utilization already mentioned, it may be expected that the future requirements will be directly related to the activity of the mining industry. National economic conditions naturally will have great bearing upon future trends in ore production, but probably a more important factor is the amount of workable reserve left in the Butte district. No estimate of the copper reserves is available.

Since the recent depression began there has been much development of mineral properties outside of Silverbow County. In 1920, 96 percent of the Montana ore was mined in this county, declining to 75 percent by 1937 as the proportion of ore from other sources increased almost sixfold.

The often-demonstrated possibilities of overnight change in the mining industry limits the value of any prediction of future wood requirements. Inasmuch as the period 1925-1937 includes a wide range of economic conditions, it is probably the best index of the needs in the near future for the State as a whole.

Northern Idaho Metal Mines

Idaho is also one of the leading metal States of the Nation, ranking first, in 1937, in the production of silver, second in lead, and fourth in zinc. According to the "Minerals Yearbook",9/ the value of the silver, lead, zinc, gold, and copper produced in Idaho during that year amounted to almost 38 million dollars. The principal mining operations are in Northern Idaho, more specifically in Shoshone County, in the comparatively small but rich region known as the Coeur d'Alene mining district. From 1925 to 1937, inclusive, approximately 90 percent of Idaho's metal ore came from this district.

Past consumption - Since the development of lode mining in the early 80's, the Coeur d'Alene district, as well as the minor Northern Idaho ore-producing areas (located principally in Bonner, Boundary, and Idaho Counties), has been a heavy user of forest products. As in the case of the Montana mines and for essentially the same reasons, the consumption of the various forms of mine timbers and lumber has fluctuated considerably from time to time as the ore production has risen and fallen. Both lumber and round products have been used in considerable quantities. Lumber includes principally lagging, squared timbers, boards, and plank. Round material includes large and small logs (stulls) used in the round state except for such hewing, framing, or sawing into shorter lengths as may be necessary for certain uses. Lumber, principally in the form of planks and sawed timbers, represents about half the timber product consumption. Approximately 10 board feet, lumber tally, have been needed for every ton of ore brought to the surface. The average annual consumption in the 13-year period 1925-1937 has been approximately 15.8 million board feet.

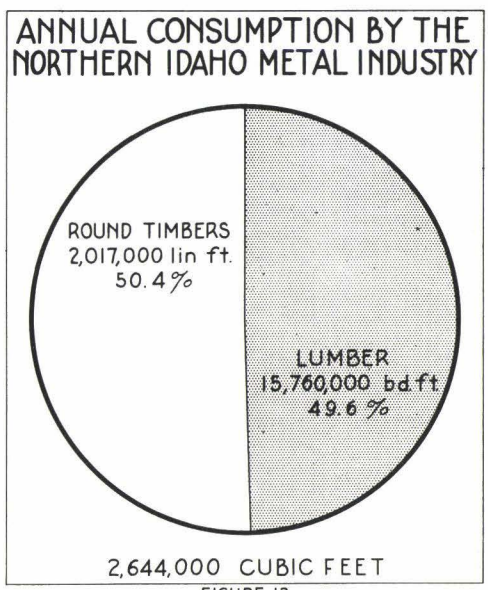


FIGURE 13

9/ Bureau of Mines, U. S. Department of Interior.

Future needs - A glance at figure 11 reveals a wide range of fluctuation in the mineral production from Northern Idaho since 1920, the low points coinciding with the two economically depressed periods in the early twenties and thirties and the peak with the prosperous late twenties. In the steady recovery from the depression low of 1932, one point is particularly significant in considering future trends. This is the fact that silver, which in 1929 and 1933 represented 16 and 24 percent, respectively, of the value produced from the mines of the Coeur d'Alene district, had by 1937 jumped to first place among the minerals, amounting to 44 percent of the value produced. This change has been largely due to the Government silver purchase policy which has been a prime factor in the revival of the local mining industry. The future of this policy will have a direct bearing upon ore production and thereby upon the future wood requirement of the mining industry.

Northeastern Washington Mines

The metal mining industry is much smaller and more recently developed in Northeastern Washington than in Montana or Northern Idaho. Nineteen hundred and twenty-nine was the first year in which the output of gold, silver, copper, lead, and zinc ore exceeded 50,000 tons. During the seven years 1931-1937, the ore production averaged but 56,956 tons, or about one-twenty-fifth as much as in Northern Idaho during the same period. Mining in this area is yet in the development stage, but it is said that the mineral resource is sufficient to support a much larger industry. It is estimated that an average of only 96,000 cubic feet of all timber products was used annually from 1931 to 1937.

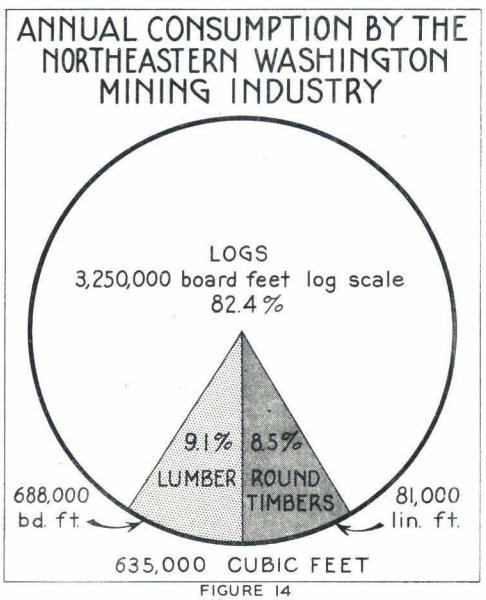


FIGURE 14

There has been a somewhat greater need for timber products by the nonmetallic minerals industry engaged in the production of dolomite and magnesite. Approximately 539 thousand cubic feet of timber products are consumed (not including fuelwood) the bulk of which is used in the manufacture of fireproof wall board in connection with the magnesite operation.

Montana Coal Mines

Coal is one of Montana's principal resources, being found in minable quantities in both the western and eastern parts of the State. The main deposits, however, are located east of the Continental Divide, and so far the coal industry has been concentrated largely in four counties, Musselshell, Carbon, Cascade, and Rosebud. The large mines located in these areas have been the principal consumers of round and sawed material, far exceeding the total utilization by the many smaller mines scattered throughout the eastern portion of the State. Only a negligible quantity of coal has been mined in Western Montana.

From the standpoint of wood requirements, the coal industry is now in its second phase. The first phase might be considered as including the period of expansion up to the 1920's. The earliest coal production statistics for Montana show a total tonnage of 224 tons mined in 1880. Records compiled by the Bureau of Mines show a steady upward trend, culminated in the three-year period 1918, 1919, and 1920, during which the average annual output amounted to 4.1 million tons. As the principal sources of this tonnage were the underground mines of Carbon, Musselshell, and Cascade Counties, the rise in production was accompanied by a corresponding increase in timber consumption.

The second period, beginning in the twenties, has been marked by a general downward trend in total production and the development of open-pit mining, factors which have resulted in lessened timber needs. Insofar as the downward production trend is due to lowered local consumption, the swing to natural gas for industrial use and home heating is a major factor. A large-scale open-pit operation began in Rosebud County in 1925, which possesses the competitive advantage of greater operating economy. Inasmuch as the market apparently is limited, the expansion of the Rosebud district has been accompanied by a decline elsewhere in Montana. In the period 1926-1936, inclusive, 35 percent of the Montana coal tonnage came from Rosebud County (see figure 11).

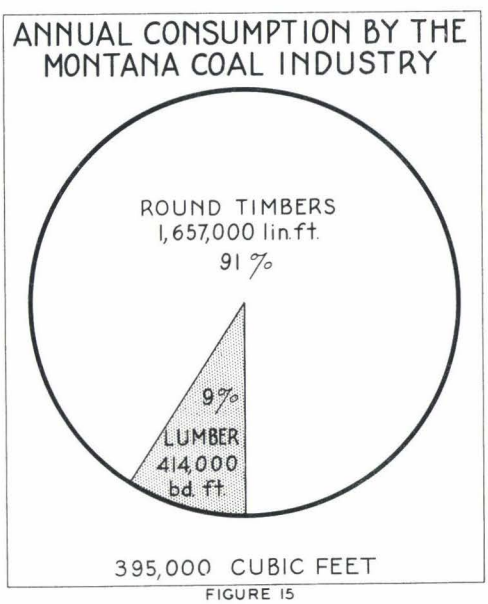
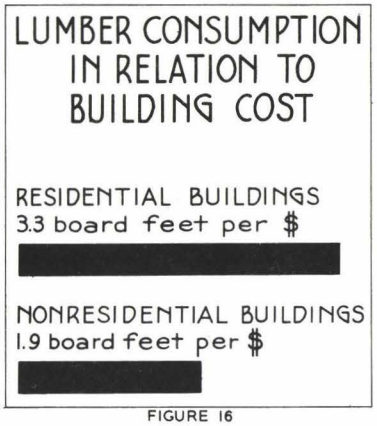


FIGURE 15

As the timber requirements for pit mining are comparatively minor, this period has seen a considerable decline in the wood needs of the coal industry.

Past consumption - Records from a representative group of large underground mining companies indicate an average consumption of .92 linear feet of round material and .23 board feet of lumber per ton of coal mined. Inasmuch as the quantity of material used underground is closely related to the quantity of coal mined and since the development of the above-surface improvements took place principally prior to 1926, the preceding consumption figures mainly fill a normal upkeep need.

If you are interested in more information on timber consumption by the mineral industry, turn to table H of the appendix.


LUMBER CONSUMPTION IN RELATION TO BUILDING COST
RESIDENTIAL BUILDINGS
3.3 board feet per $
NONRESIDENTIAL BUILDINGS
1.9 board feet per $
FIGURE 16

CONSUMPTION OF LUMBER AND SHINGLES FOR NONFARM CONSTRUCTION

The population of the region may be classified into two broad groups according to residence: "farm" and "nonfarm." Nonfarm population is further divided by the Bureau of Census into: (1) urban, including incorporated cities and towns of 2,500 or more people, and (2) rural nonfarm, including smaller communities and scattered families not living on farms.

Twenty-five incorporated cities and towns,10/ with a total population of 330,000 people in 1930, are classified as urban. Two-thirds as large, the rural nonfarm population was 233,000. The nonfarm population was distributed as follows:

	Urban	Rural nonfarm
Eastern Montana	101,946	103,041
Western Montana	79,090	49,567
Northern Idaho	33,224	48,596
Northeastern Washington	115,514	31,519
Total	329,774	232,723

Approximately 8 percent, or 40 million board feet, of the lumber annually consumed within the Northern Rocky Mountain Region enters into nonfarm construction. This includes only the lumber used for construction and repair of residences, construction and repair of nonresidential buildings, and for uses by municipal government such as the construction of bridges and culverts. It does not include the volume utilized for industrial purposes. Shingles, of which 79,000 squares are used annually, represent the only other timber product consumed in large quantities in nonfarm construction. The importance of the nonfarm shingle market may be realized from the fact that 79,000 squares will shingle an area 100 feet wide and 15 miles long.

10/ Spokane, Washington; Lewiston, Moscow, Coeur d'Alene, Kellogg, Sandpoint, and Wallace in Idaho; Great Falls, Bozeman, Livingston, Billings, Miles City, Helena, Havre, Lewistown, Glendive, Laurel, Roundup, Red Lodge, Butte, Missoula, Anaconda, Kalispell, Whitefish, and Deer Lodge in Montana.

Table 9. - Consumption of lumber and shingles in nonfarm construction, 1929

Subregion	Lumber	Shingles
	Thousand board feet	Thousand squares
Eastern Montana	15,778	28.2
Western Montana	6,003	17.3
Northern Idaho	5,743	12.3
Northeastern Washington	12,130	20.8
Total	39,654	78.6

One of the early evidences of a falling economic barometer generally has been a decline in the construction industry. During periods of retrenchment, building activity has slowed to a virtual standstill. The year-to-year variability arising from economic factors makes it difficult to estimate "normal consumption." Then also, the communities of this region have not yet become stabilized. Still in the expansion stage, it is impossible to predict with any degree of accuracy at what point nonfarm population - and thus indirectly nonfarm construction - will level off.

Riding the industrial expansion of the past half century, the communities of this region attained most of their growth in the 30-year period between 1890 and 1920. Although Butte and several other cities and towns declined following 1920, the nonfarm population on the whole has continued to grow but at a slower rate since that time. Beginning in 1927 nonfarm construction entered a period of gradual decline, decelerating sharply in 1930, and virtually ceasing during 1932 and 1933. The upswing began in 1934 and has continued to the present time. In several cities this recovery has carried residential construction beyond the 1929 level. Neither in the crest nor trough of building activity, 1929 perhaps affords the best indication of normal consumption of building materials in the Northern Rocky Mountain Region. The preceding lumber and shingle estimates have been based on this year.

Residential Construction

The amount of home construction in any community depends upon the ability of its residents to meet such demand for homes

as is created by two factors - the need for providing living quarters to care for increases in the number of families and the need for replacing living quarters which through long service, or for some other reason, are no longer suitable for habitation.

It is estimated that the majority of nonfarm residences are now 40 years or less in age. Since 50 years is most often considered as a reasonable average life expectancy for nonfarm homes, it is evident that there is as yet no considerable volume of replacement and that this construction was principally due to population growth. In 1929 it is estimated that 1,562 dwelling units were erected in the nonfarm areas of this region, 27.8 for each 10,000 population or 10.5 for every thousand families. Indications are that for the next decade also the nonfarm construction will be largely due to further increases in the number of nonfarm families. Eventually, however, construction as a result of this factor will fall off and construction due to replacement will increase. On the basis of a 50-year service period for buildings, the ultimate building rate would be approximately double that of 1929 (20 per 1,000 families instead of 10.5). It should be recognized that 50 years is an arbitrary figure chosen in the absence of conclusive information on the life expectancy of the present-day dwelling. The actual rate of renewal in the coming years will probably depend more than anything else upon the future economic vitality of this region. Hallauer, after analysis, is inclined to predict an 80-year average life for nonfarm dwellings over the Nation as a whole.11/ In view of the number of relatively low standard structures, this would seem to be a rather optimistic guess as far as this region is concerned. Yet even an 80-year service period would require a higher rate of construction than in 1929.

The urban building rate is far from uniform in any one year, the positions of the cities in their individual construction cycles causing wide differences between them; but over a period of years the variation is naturally less.

It will be noted in table 10 that the building rate in Butte during 1929 is almost unbelievably low - 1.2 dwelling units per 10,000 population. The city grew with the development of its copper resources until 1920. Since that time it has been much less prosperous and the number of residents has decreased considerably. In 1933, when an occupancy survey was made by the Civil Works Administration, approximately 16 percent of all dwelling

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11/ Lumber Requirements for Nonfarm Residential Construction, Forest Service, Washington, D. C., 1939.

Table 10. - Urban dwelling units constructed in 1929 per 10,000 population, from records and estimates

Eastern Montana		**Western Montana**	
Great Falls	108.9	Butte	1.2
Bozeman	37.9	Missoula	39.5
Livingston	14.1	Anaconda 1/	20.0
Billings	51.3	Kalispell 1/	40.0
Miles City	20.9	Whitefish 1/	20.0
Helena 1/	20.0	Deer Lodge 1/	20.0
Havre 1/	40.0		
Lewistown 1/	20.0	**Northern Idaho**	
Glendive 1/	40.0		
Laurel 1/	40.0	Lewiston	82.9
Roundup 1/	20.0	Moscow	84.9
Red Lodge 1/	20.0	Kellogg 1/	40.0
		Coeur d'Alene 1/	40.0
Northeastern Washington		Sandpoint 1/	40.0
		Wallace 1/	40.0
Spokane	36.3		

Weighted average 38.9

1/ Estimated.

units in the city were reported vacant. At the present time, although the higher quality homes are not too plentiful, there appears to be no shortage of habitable living units. Thus, there is little reason to expect any marked increase in building activity at Butte.

Rural nonfarm building in 1929 averaged 12 living units per 10,000 population, a very low figure in comparison with the average of 38.9 dwelling units for urban areas as shown in table 10. This low rate must sooner or later be greatly increased to satisfy the normal need for replacements.

Approximately 18.8 million board feet of lumber were consumed during 1929 in the construction of the 1,562 new living units. Further, 5.8 million board feet were used for repairs and additions to residential buildings already standing, bringing the total lumber consumption for this purpose to almost 25 million board feet. In addition, 76,000 squares of shingles were consumed in roofing and reroofing residential buildings.

Building material needs for housing depend to a great degree upon the type of structure. Although, in total, an apartment building ordinarily will contain much more lumber than a one-family house, the average single-family dwelling requires 42 percent more lumber than each living unit of the multi-family building. Only 2.8 percent of the rural nonfarm families in the region reside in apartments whereas this type of dwelling houses 13 percent of the urban population.

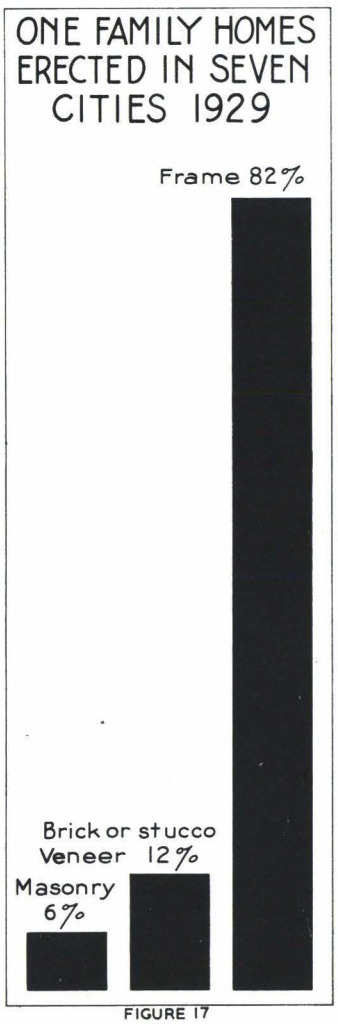

FIGURE 17

Percent of families residing in:

	Urban	Rural nonfarm
One-family dwellings	80.4	90.3
Two-family dwellings	6.6	6.9
Apartments	13.0	2.8
	100.0	100.0

The typical one-family nonfarm house is small, containing approximately 12,500 board feet of lumber. Allowing for a full basement it has about 18,000 cubic feet of space from foundation footing to peak, which is one cubic foot for every .694 board feet of lumber.12/ This 12,500 board feet represents an average of all types of single-family homes from the occasional mansion to the numerous shacks. Eliminating the latter and including only the better type homes, the average lumber content of the composite single-family house is probably near 15,000 board feet.

One-family homes in the region are predominately frame structures. Detailed records of 1929 construction in seven larger cities13/ show that 532 or 82 percent of 645 single-family houses erected in that year were all-wood. The proportion of frame houses is even greater in the small towns and villages.

12/ Includes windows, doors, and millwork but not shingles.
13/ Spokane, Butte, Great Falls, Missoula, Livingston, Lewiston, and Bozeman.

No significant difference is apparent between single and duplex homes in the ratio between cubic content and lumber volume. The living unit in the double house is somewhat smaller, however, requiring only 9,950 board feet of lumber for its construction. Multi-family dwellings contain a still smaller average living space per family. The lumber required per living unit is 8,775 board feet or .925 board feet per cubic foot. The higher ratio is due to two facts: the rooms are smaller and the wall area greater in relation to living space, and the basement makes up a lower proportion of the building. Only 13 percent of the apartment units erected in 1929 were of so-called fireproof construction. A few were all-wood but the majority were wood with a brick outerwall.

For residential buildings of all kinds the relation between the volume of lumber used and the cost of construction may vary widely. Even in the frame house, lumber ordinarily is but a small portion of the total investment, such items as hardware and labor having greater effect upon the price. An analysis of three million dollars of residential building in these seven cities indicates, however, that when the construction costs are known for a number of residential buildings an adequate approximation of the lumber consumed can be obtained by multiplying the cost by a factor of 3.3 board feet per dollar.

Records of the lumber consumption for alteration and repair of residential buildings are much less satisfactory than

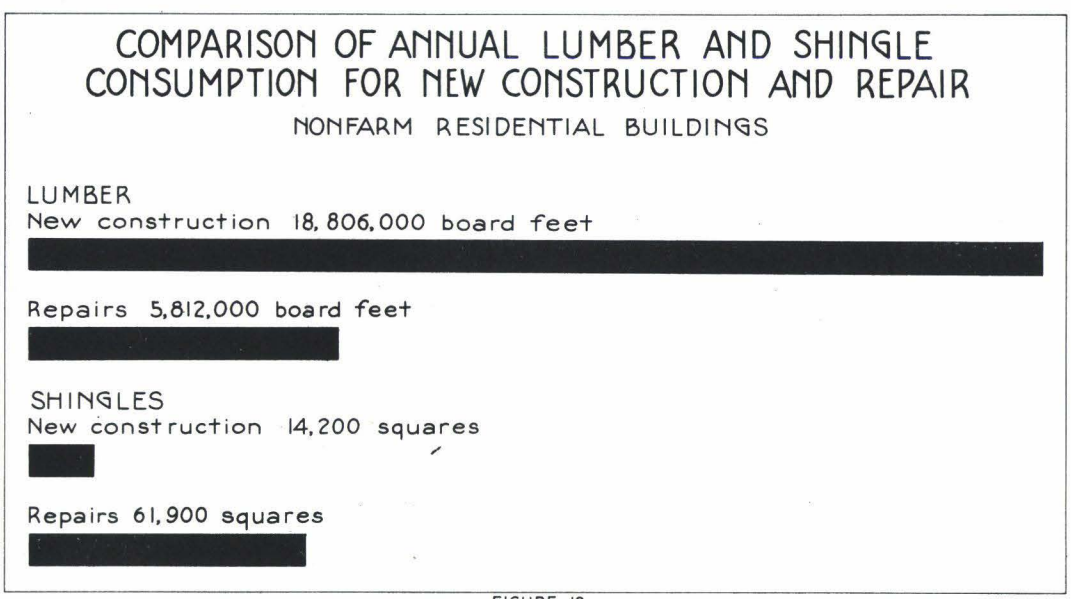
COMPARISON OF ANNUAL LUMBER AND SHINGLE CONSUMPTION FOR NEW CONSTRUCTION AND REPAIR
NONFARM RESIDENTIAL BUILDINGS
LUMBER
New construction 18,806,000 board feet
Repairs 5,812,000 board feet
SHINGLES
New construction 14,200 squares
Repairs 61,900 squares

FIGURE 18

data on new construction. However, it is estimated that 5,812,000 board feet of lumber were consumed for repairs and alterations in 1929, making an average of 10 board feet per capita. It is thought that the ratio of 3.3 board feet per dollar of repair and alteration cost also applies.

Shingle consumption has been calculated on the basis of 16 squares per dwelling. Records for Missoula, Livingston, and Bozeman indicate that one-third of the homes are covered with nonwood shingles. On that basis it is estimated that two-thirds of the single and duplex dwellings erected in 1929 had wood shingle covering, for a total consumption of 14,200 squares. The principal nonfarm market for the cedar shingle is not for new construction but for replacing deteriorated roofing on older buildings. The average life expectancy of a wood shingle roof is 20 years. On this basis 61,900 squares were consumed for repairs to residential buildingsin 1929.

Nonresidential Buildings

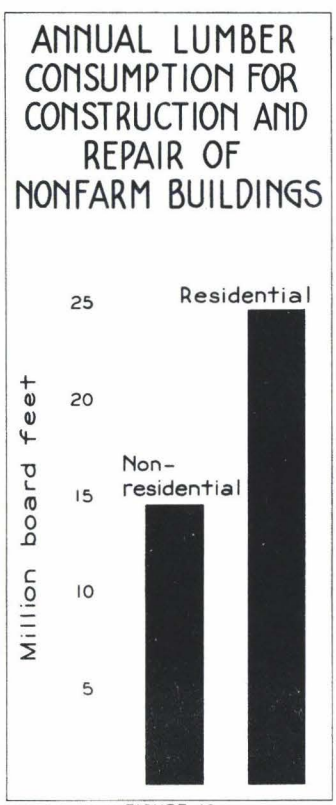

FIGURE 19

Private garages, stores, warehouses, factories, and other nonresidential buildings, comprise a smaller part of the nonfarm building construction. In 1929, 14.5 million board feet of lumber and 2,500 squares of shingles were consumed in construction and repair of nonresidential buildings. Of the lumber 12.3 million board feet entered new construction.

As in the case of the dwellings, the bulk of the nonresidential construction in 1929 took place in the cities and towns of 2,500 or more people. Ninety-five percent of the lumber and 85 percent of the shingles were consumed in these towns.

While some communities maintain a detailed tabulation of the buildings erected within their limits, for many the records are more or less incomplete. In many cases the most than can be expected in the way of summarized data on nonresidential construction is figures showing

the total reported cost of the structures erected and repairs made during a single year. An approximation of the lumber consumed in nonresidential construction may be had by multiplying the cost in dollars by a factor of 1.9 board feet.

Urban Construction Other Than Buildings

Besides the volume consumed for urban building construction and repairs, a considerable quantity of lumber is purchased by city governments for use in maintenance and new construction work done by their own employees. The bulk of such material consists of 2-inch and 3-inch plank used for crosswalks, bridge decking, catch basins, storm sewers, forms, etc., required in the maintenance of city streets. Information on the average annual requirements for such purposes was obtained from city engineers in the cities of Spokane, Washington; Lewiston, Idaho; Butte, Bozeman, Livingston and Great Falls, Montana. The weighted average annual consumption by these cities, based for the most part on annual requirements during the period from 1927 to 1932, amounted to 1.73 board feet per capita. The estimated consumption figures shown in table 11 below were derived by applying this conversion factor to urban population figures for each subdivision of the region:

Table 11. - Estimated annual consumption of lumber and other sawed material by municipalities of 2,500 population or more

Subregion	Total consumption
	Thousand board feet
Eastern Montana	176
Western Montana	137
Northern Idaho	57
Northeastern Washington	200
Total	570

See table I of the appendix for a more detailed record of consumption.

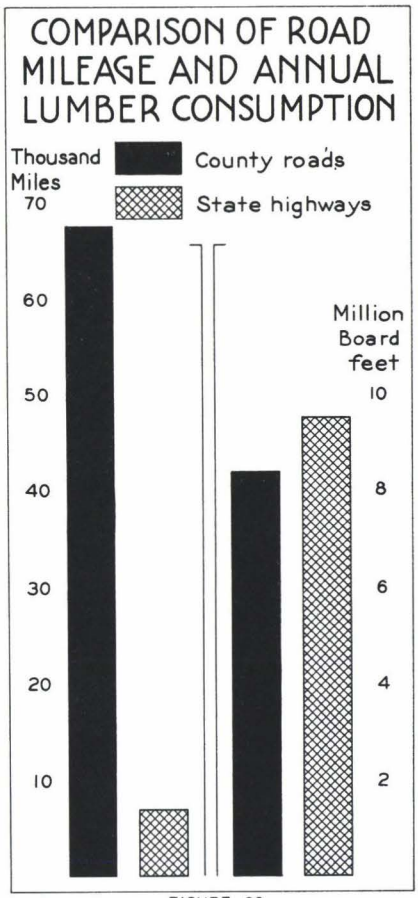

FIGURE 20

THE CONSUMPTION OF LUMBER AND PILING IN THE CONSTRUCTION AND MAINTENANCE OF STATE AND COUNTY HIGHWAYS

Highway construction and maintenance is a big business. In the State of Montana alone 56 million dollars were spent from January 1, 1927 to July 1, 1936 in constructing State highways. This does not include maintenance nor does it cover the county road systems of which there are many hundreds of miles.

For the purpose of estimating timber product requirements the roads of the region may be divided into three general groups. The greatest aggregate distance is under the supervision of the counties, a total of almost 68,000 miles. The State highway departments administrate an additional 6,900 miles of highways, which includes the Federal-aid highways. The third group includes the roads within the national forests, the Indian reservations, Glacier Park, and the National Bison Range, which are maintained by these agencies. No mileage estimates have been compiled for this group, as the consumption of timber products in the building and upkeep of the roads is included in the unsegregated consumption data of these agencies, which is discussed in another section.

Per mile of road the annual use of wood products is comparatively small. However, by reason of the very great mileage the total yearly consumption of wood products in the construction and maintenance of State and county highways amounts to 17.9 million board feet of lumber and 333 thousand linear feet of piling. Although practically every forest product is used to a greater or less extent, the principal items are guide posts, guard rails, guard posts, timbers, planking, boards, snow fence (most of which in recent years have been sawed material), and piling.

Table 12. - Annual consumption of lumber and piling in construction and maintenance of State and county roads

Subregion	Lumber	Piling
	Thousand board feet	Thousand linear feet
Eastern Montana	11,386	209
Western Montana	2,040	35
Northern Idaho	2,715	57
Northeastern Washington	1,741	32
Total	17,882	333

State Highways

The State highway departments have been consuming large quantities of lumber and piling during the last decade or so, in which their road building programs have been greatly extended. In Montana the expansion began in 1927, following the passage of a three-cent gas tax, and the road program expanded once again in 1931 with a two-cent addition to the tax. With the increased emphasis placed on good roads, the trend has been similar in Idaho and Washington, varying only as to dates and the details of financing. The expenditures of the past several years have been augmented by Federal relief money given in addition to the funds appropriated in the regular Federal highway aid program. It is estimated that approximately 9.5 million board feet of lumber and 173 thousand linear feet of piling are annually used in construction and maintenance of State highways.

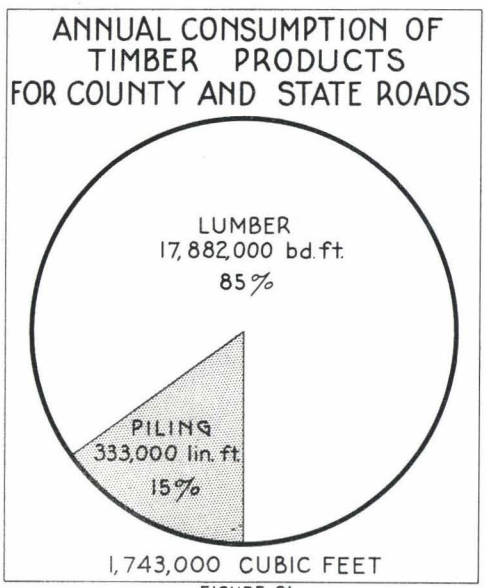

FIGURE 21

By far the larger part of this material is used in construction projects. Excellent data obtained from the Montana Highway Planning Survey have enabled a breakdown of the consumption into the volume used in construction and the volume

required for straight maintenance work, which data indicate that 92 percent of the material has entered into the former phase of the program. With the constant emphasis on roads of a higher standard, it seems likely that this general relationship will continue for the coming few years at least.

The volume of wood consumed per mile of State highway construction apparently depends upon the topography and other physical factors as well as the type of construction contemplated. Notwithstanding, upon comparing the cost of all Montana projects for the seven years 1927, 1928, 1929, 1930, 1932, 1933, and 1934 with the total amount of wood used in connection with these projects, a strong relationship is apparent between cost and wood consumption. During these seven years it is estimated that 860 board feet of sawed material were used for every thousand dollars expended. Of this, 586 feet entered into actual structures such as guard rails and wood culverts, the remaining 274 board feet being used for forms.14/ These same records indicate that piling was consumed at the rate of 14.1 linear feet per thousand dollars expended.

In the year-in and year-out maintenance which includes the periodic replacement of guard rails, culverts, and other timber structures, it has been estimated by the Montana State Highway Department that the major timber products are used at the rates indicated in the tabulation following:

Table 13. - Estimated annual consumption of timber products per mile of road in the maintenance of Montana State highways

Item	Consumption per mile per year	
	Western Montana	Eastern Montana
Boards and plank - board feet	81.00	55.00
Sawed timbers - board feet	37.00	23.00
Guard rail posts - pieces	.64	.28
Guide posts - pieces	.24	.17
Total of above - board feet	146.00	92.00
Piling - linear feet	2.75	2.75

14/ As no record of form lumber used was available, it was estimated on the basis of 100 board feet per cubic yard of concrete.

County Highways

There are 56 counties in Montana, ten in Northern Idaho, and three in Northeastern Washington. These counties differ widely in their financial status, and also in the physical conditions which influence the maintenance and reconstruction of their roads. These two factors naturally regulate the amount of material used each year. For the region as a whole, based on data covering 14,000 miles of local roads, the average annual consumption of sawed products is approximately 124 board feet per mile. In addition 2,37 linear feet of piling are used per mile of road.

While the county road systems are almost ten times as long as the State highway systems as shown in figure 20, the timber use is slightly lower. Approximately 8,4 million board feet of lumber and 160 thousand linear feet of piling are utilized annually in construction and upkeep of county roads.

Trends

While no definite assertion is possible as to future trends in State road programs and thus indirectly in consumption of timber products, it is the opinion of those associated with State highway development that no marked curtailment is in prospect. Likewise, there is no reason to believe that wood consumption on county roads will differ materially from past years. Also, no particular trend is noticeable at present toward a reduction of the volume of wood used per mile of road or per dollar expended, such as might be caused by the general use of substitute products. On the contrary, it is said that the use of laminated wood guard rails has been favored in Montana as an aid to the State lumber industry.

More detailed statistics on State and county highway consumption are contained in table J of the appendix.

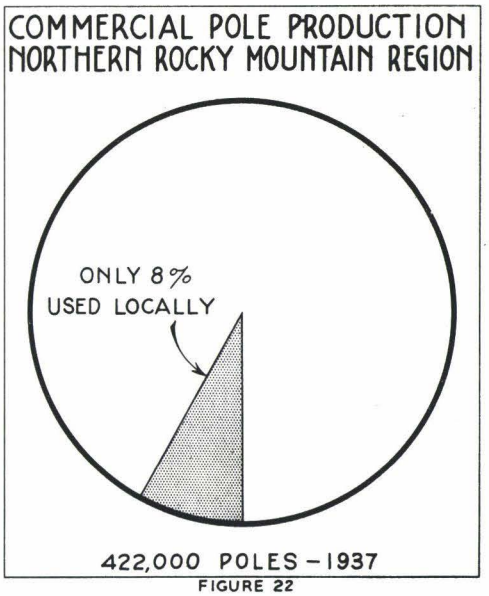

FIGURE 22

CONSUMPTION OF TIMBER PRODUCTS BY PUBLIC UTILITIES

In the entire Northern Rocky Mountain Region there are approximately 37,500 miles of pole line bearing electric, telephone, and telegraph wires. The concerns and organizations operating these lines are estimated to use about 894,000 cubic feet of timber products each year in maintaining and extending their services. While this volume may seem small when compared with other types of consumption, it is relatively more important considering values, as poles comprise roughly eight-tenths of the total volume and represent a far greater investment than an equal volume of lumber.

The consumption of poles and other materials by the individual agency may and often does vary from year to year over a period of time. The aggregate annual needs have been estimated, however, on the basis of the average service life which may be expected from the poles, stubs, and crossarms now in use, assuming a steady turnover from year to year. The service life of poles and stubs under different conditions varies widely, but sufficient service data have been collected to enable a reasonable estimate of the consumption over a long period.

There are, in round numbers, about 1,100,000 telephone and electric poles in service in the Northern Rocky Mountain Region. The average useful life of these poles is expected to be about 19 years, requiring replacement of 59,000 annually. A 19-year average life cannot be obtained without "stubbing" a portion of the poles. On the basis of past practice 10,000 stubs will be used annually - 9,000 round and 1,000 sawed. Average crossarm needs have been calculated to be about 55,000 pieces annually. In the ordinary run of construction and reconstruction of power and communication systems very little lumber is used except for crossarms and sawed stubs. A more or less isolated exception is the recently completed Polson power dam in Western Montana which is

estimated to have required the use of about 3 million board feet of lumber in 1936, 1937, and 1938, or a million board feet annually. Additional lumber consumption of this nature may be expected periodically.

Table 14. - Estimated annual consumption of timber products by public utilities

Subregion	Poles	Stubs		Other lumber
		Round	Sawed	
	Pieces	Pieces	Pieces	Thousand board feet
Eastern Montana	29,250	4,230	350	293
Western Montana	11,420	1,600	540	1,101
Northern Idaho	12,030	1,513	80	77
Northeastern Washington	6,085	1,430	120	67
Total	58,785	8,773	1,090	1,538

Two factors, pole spacing and service life, regulate the volume of annual replacements. On lines erected by the Rural Electrification Administration, 15 poles per mile appears to be the customary number. Eighteen or 19 poles are normally required for each mile of power transmission line owned by commercial companies. The spans are somewhat shorter for power distribution lines of commercial companies and for telephone and telegraph systems, the usual range being between 30 and 35 poles per mile. On the other extreme the maximum requirements are for trolley lines which contain an average of 54 poles per mile. Service life likewise varies considerably depending upon a number of factors, several of which are more or less controllable, such as the extent of preservative treatment, the amount of stubbing, and the size of the poles.

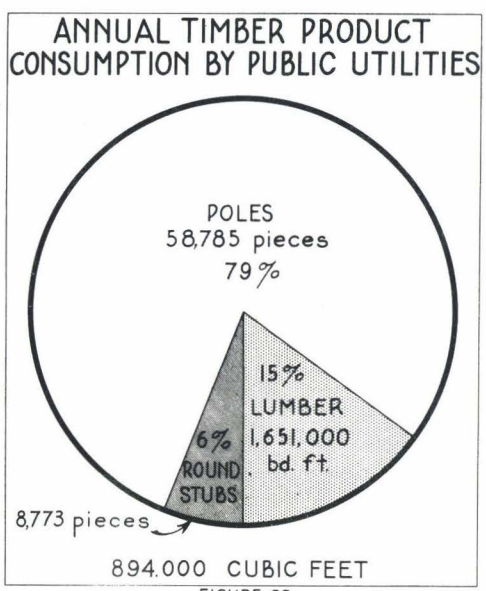

FIGURE 23

In contemplating future wood requirements there are two

opposing considerations to be reckoned with. It is likely that considerable effort will be made to extend the life of poles by preservative treatment and thereby reduce replacements. The mileage of pole line will probably be extended, thus tending to increase pole needs. In the light of present knowledge no more can be done than to assume that these trends will neutralize each other.

No material changes are likely in railroad telephone and telegraph lines or in publicly owned telephone lines (Forest Service, etc.), the mileage of poles having been more or less stable for a number of years. Power lines and privately owned telephone lines will undoubtedly continue to be extended as the expansion, interrupted by the depression, is resumed to some degree. Need for this expansion is particularly evident in the field of power distribution, as the bulk of the farm homes are yet without electric current. According to the "Montana Farmer,"15/ only 5.5 percent of the farms in this State were served by central station electricity in 1935. Instituted to remedy this situation, the Government-sponsored Rural Electrification Administration has made great strides in reducing the number of unelectrified homes during the several years of its existence. Most of the new line constructed in recent years has been in connection with these projects. With the completion of the projects authorized up to January 1939, 11,000 rural customers in the Northern Rocky Mountain Region will have received central station power through the R.E.A.

The saturation point in the potential rural market depends largely upon how much the expansion continues to be subsidized by the Federal Government; nevertheless, many rural homes are too remote to be profitably brought within the range of central power. Also the need for central power has been reduced by the development of efficient home plants. The R.E.A. has equipped 3,200 Montana homes 15/ with stationary plants and 1,779 with wind generators, the latter having proved very practical in the eastern portion of the State.

The Inland Empire is one of the major pole producing centers of the Nation. The output of poles from this area exceeds the local needs to a far greater extent than the lumber production exceeds the local requirements. In 1937, according to a timber products census, 420,410 poles, mainly cedar, were produced in Western Montana, Northern Idaho, and Northeastern

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15/ November 1, 1938.

Washington. This is principally a record of commercial production, as it was impracticable to secure a record of the hundreds of poles used on the numerous scattered farmer lines and those used for maintenance of national forest lines, etc. The local market for commercially produced poles is, with few exceptions, represented in the needs of the railroads, the telegraph companies, the larger telephone companies, the power companies, and the Rural Electrification projects. The average annual pole needs of these agencies in the Inland Empire are about 17,740 poles or four percent of the commercial output of this area. In Eastern Montana the commercial production of poles is negligible, whereas the commercial consumption of 17,460 poles nearly equals that of the three western subregions. The following tabulation is made comparing production and requirements:

Table 15. - Comparison of commercial pole consumption and production in the Northern Rocky Mountain Region

Subregion	Commercial pole production 1937	Commercial pole consumption
	Pieces	Pieces
Eastern Montana	1,772	17,460
Western Montana	27,008	6,780
Northern Idaho	376,123	5,860
Northeastern Washington	17,279	5,100
Total	422,182	35,200

Appendix tables K and L contain more data related to wood products use by public utilities.

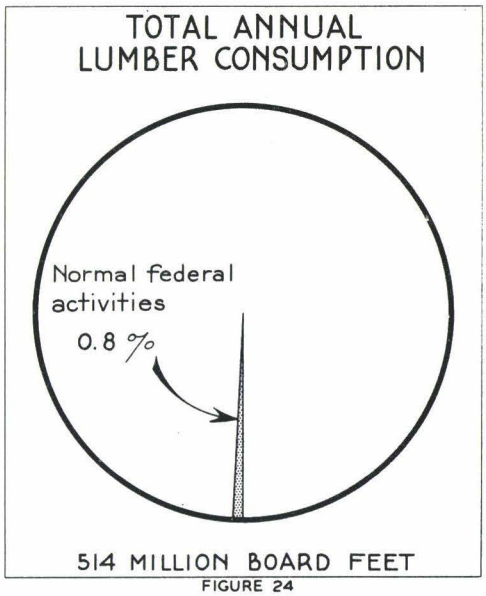


FIGURE 24

CONSUMPTION OF TIMBER PRODUCTS BY FEDERAL AGENCIES

Six agencies participate more or less in the administration of the vast area of land in this region which is Federally owned or managed. These are the Army, Office of Indian Affairs, Civilian Conservation Corps, National Park Service, Forest Service, and Biological Survey. Besides normally using a little less than 1 percent of the lumber consumed in the region, these Bureaus annually utilize a sizable volume of other timber products. With one exception their present needs represent a fairly normal demand which may be expected to continue in some degree as long as the present administrative functions are being carried on. This single exception, a most important one, is the consumption in connection with the Fort Peck Dam being built in Eastern Montana under Army supervision. This dam was begun in late October 1933 and during the 62 months between then and January 1, 1939, 47 million board feet of lumber alone entered into its construction. This is a little over 9 million board feet per year. Although the completion date has been set at March 1941, the project has passed the stage of heavy wood requirements and it is expected that an additional 2 million board feet will finish the job. While possible, it is not likely that an equally gigantic project may be expected in the near future, and for that reason the total consumption by the Federal Government will be considerably less during the next few years. So the material required for the Fort Peck Dam is not included (figure 24 and table 16) with that used in connection with more normal Federal activities.16/

16/ The consumption of poles is included in the section on power and communication systems for convenience in analyzing. Fuelwood and fenceposts are likewise considered in separate sections on these subjects. The record of lumber shown in the table includes material used for buildings, bridges, culverts, and all other purposes. In the case of the Indian Reservations, an attempt has been made to eliminate the volume used for the Indian dwellings as this is contained in the estimates of farm and rural nonfarm construction.

Table 16. - Consumption of lumber by Federal agencies in the Northern Rocky Mountain Region, not including that used on the Fort Peck Dam, 1938 1/

Subregion	Consumption
	Thousand board feet
Eastern Montana	780
Western Montana	1,670
Northern Idaho	1,120
Northeastern Washington	350
Total	3,920

1/ Fiscal Year, July 1, 1937 to June 30, 1938.

The total of nearly four million board feet normally consumed is only four-tenths as much as the volume of sawed material used annually over the past five-year period at Fort Peck. As previously mentioned, 47,135,000 board feet of sawed material have been used at the Fort Peck Dam since October 1933. Only 33,388,000 board feet have entered into actual dam construction, the remainder being used for office buildings and residences. Besides these sawed products, 37,622 poles and 1,008,766 linear feet of piling were used. The piling included many long pieces, the average length being 36 feet. The timber products used at this dam are not, as previously mentioned, included in the totals of consumption carried in this and other sections of the report.

"STAGGERING" IS THE WORD WHICH BEST DESCRIBES THE SIZE OF THE FUELWOOD CONSUMPTION IN THIS REGION. APPROXIMATELY 1.3 MILLION CORDS ARE ANNUALLY BURNED FOR HEAT AND POWER. YET IN A REGION WHICH IS HEAVILY DEPENDENT UPON WOOD FUEL THIS IS ONLY 6 CORDS PER FAMILY. HALF OF THIS WOOD IS CUT FROM GREEN TREES, THE REST BEING SCRAPS, SLABS, AND DEAD TIMBER.

CONSUMPTION OF FUELWOOD BY ALL AGENCIES

The problem of furnishing fuel for the long and severe winters in this northern climate is one of major importance. In the Plains Area of Eastern Montana the local needs are mainly supplied from the extensive beds of coal underlying this part of the State. No coal deposits of any particular significance are to be found in Western Montana, Northern Idaho, or Northeastern Washington; consequently, in these areas the burden of furnishing the vast volume of fuel falls heavily upon the forest stands. While, because of their greater convenience, coal and natural gas supply most of the heat in the larger urban centers of the Inland Empire, much wood fuel still is consumed in these cities, and in the smaller towns and rural areas wood is very nearly the only fuel used. Even in Eastern Montana, where coal is so abundant and natural gas is also available, a large amount of wood is burned yearly, for although the consumption in much of the Plains country consists mostly of kindling scraps there are forested sections where the cordwood drain is heavy.

Woodcutting is seldom a large scale operation comparable with lumbering. Nevertheless, the aggregate drain of this product upon the forest resources is surprisingly large. The green timber cut for fuelwood is equivalent to approximately one-third the volume felled for lumber. It is estimated that annually 622 thousand cords of green-cut wood are used as fuel. In addition to this, 44 thousand cords of slabs and millwood and 600 thousand cords of dead timber and miscellaneous scraps are burned each year, bringing the total fuelwood consumption to 1,266,100 cords. The annual consumption of fuelwood is shown in the following table:

Table 17. - Consumption of fuelwood in the Northern Rocky Mountain Region, 1934 1/

Subregion	Cords 2/	Thousand cubic feet
Eastern Montana	392,700	33,772
Western Montana	301,100	25,895
Northern Idaho	339,200	29,171
Northeastern Washington	233,100	20,047
Total	1,266,100	108,885

1/ This does not include the slabs and waste consumed in sawmills.
2/ Standard (4'x4'x8') cords, including bark.

City and Town Consumption

Special fuelwood use studies were made in the towns and cities of 1,000 population and larger. In each town or city information was gathered from varying sources, such as wood and coal dealers, to determine the volume of fuelwood used in 1934.

Although the city of Spokane, Washington, relies principally upon coal heat, approximately 74,000 cords of dead and green-cut forest fuelwood entered this community by truck and rail in 1934. It is estimated that in addition to this wood at least 10,000 cords of slabs and mill scraps were burned during the same year. Missoula, Montana, likewise a coal town, burned 10,500 cords of wood altogether in 1934. In Butte, Anaconda, and Deer Lodge, Montana, natural gas rather than coal is the main source of heat and power, yet the many persons hauling wood to these towns during that year logged about 27,000 cords. These five communities represent the principal coal and gas consuming areas in the Inland Empire.

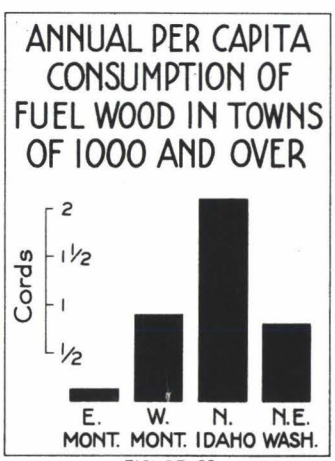


FIGURE 25

Several lumber mill towns have turned to sawdust or hog fuel because of its economy. Practically the entire business district of Lewiston, Idaho, is heated with this form of fuel. In the vicinity of Lewiston, 4,528 tons of compressed ground mill waste were sold in 1934. This product has also begun to command a market in several other cities.

In all Inland Empire cities and towns of 1,000 population and over, 287,000 cords of deadwood, slabwood, and green-cut wood were burned for fuel in 1934. Less than 18,000 cords of fuelwood are burned annually in Eastern Montana towns and cities or a little more than .1 cord for each of the 134 thousand persons. Except for Dillon, where the 1934 consumption was about eight cords per dwelling, the urban use of fuelwood in this part of Montana is very small, the main demand being for kindling. In recent years even the need for kindling has declined with the piping of natural gas to many homes. In 1935 approximately 51 percent of the urban dwellings were heated with gas, the percentage of commercial gas users being likewise high. In the city of Shelby cooking and heating requirements are supplied by gas almost exclusively and only three important cities, namely, Roundup, Lewistown, and Dillon, were in 1934 not served by the extending network of mains.

Rural Consumption

Comparison of figures 25 and 26 shows that fuelwood consumption per capita is considerably higher outside the cities and towns. As already mentioned, cordwood is the principal, and in most cases practically the only, fuel used in the rural areas west of the Continental Divide. The wood consumption per dwelling averages 9.5 cords in Northeastern Washington, 11.9 cords in Northern Idaho, and 13.8 cords in Western Montana. The difference in these averages may be attributed to the amounts of coal consumed in each locality, the relative severity of the winters, and the different proportions of green-cut fuelwood available. Rural fuelwood consumption includes the wood burned in rural schools and commercial establishments, CCC camps, etc., as well as home consumption. The average amount of wood burned per rural home in Eastern Montana is six cords. The low consumption of one-half cord per family in the northeastern corner of the State is counterbalanced by fuelwood requirements ranging upward to an average of 21 cords in a few limited areas. A small number of rural homes are heated by natural gas, but the principal fuel is coal - lignite and bituminous - which is fortunately abundant and easily accessible in most of the nonforest area. In table 18 on the following page the

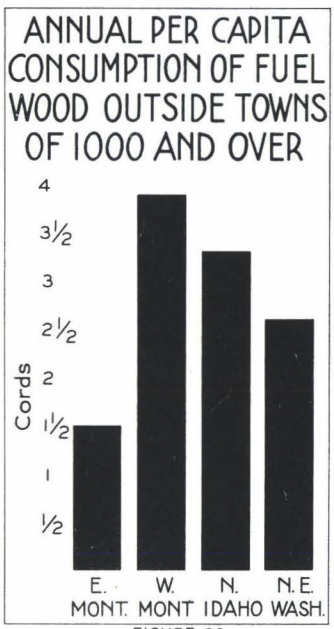


FIGURE 26

consumption of fuelwood is shown separately for rural areas and for incorporated towns of 1,000 population and larger.

Table 18. - Consumption of fuelwood in the Northern Rocky Mountain Region by type of community, 1934

Subregion	Incorporated towns of 1,000 population and larger 1/	Rural 2/	Total
	Cords	Cords	Cords
Eastern Montana	17,900	374,800	392,700
Western Montana	94,300	206,800	301,100
Northern Idaho	95,200	244,000	339,200
Northeastern Washington	97,300	135,800	233,100
Total	304,700	961,400	1,266,100

1/ Including Potlatch and Lewiston Orchards in Idaho and the suburbs of Butte, Billings, and Helena in Montana.
2/ Including all area not in towns of 1,000 population and larger.

Types of Fuelwood

It has been mentioned previously that only a part of the 1,266,100 cords of wood required annually for fuel represent a direct drain from the green-timber resources. The total also includes slabwood, millwood, deadwood, old ties, used fenceposts, and other discarded wood products. In table 19 are shown the computed volumes of the various types of wood consumed in the region during 1934.

Table 19. - Consumption of fuelwood by type of wood and species in the Northern Rocky Mountain Region, 1934

Type of wood and species	Eastern Montana	Western Montana	Northern Idaho	N. E. Wash.	Total
	Cords	Cords	Cords	Cords	Cords
Green wood	163,100	93,700	175,200	189,600	621,600
Deadwood & scraps	229,400	195,100	143,900	31,900	600,300
Slabs & millwood	200	12,300	20,100	11,600	44,200
Total all wood	392,700	301,100	339,200	233,100	1,266,100

Trends of Consumption

The question arises as to what extent these fuel consumption figures based on a single year can be considered as average. In the Inland Empire the economic depression resulted in an "above normal" use of wood, at the expense of coal in Spokane, Butte, Missoula, Anaconda, and Deer Lodge at the time the survey was made. The same is true, only to a much less extent, in other towns in the western part of the region. The 1934 consumption of fuelwood in these cities, although above the normal figure, is said to have been less than during the two preceding years. The forest fuelwood burned in Spokane amounted to 100,000 cords during 1933 as compared with 74,000 cords in 1934. Improved economic conditions since the latter year and the increasing scarcity of available wood in the vicinity of these cities have undoubtedly reduced the urban use in the Inland Empire still more; nevertheless, much fuelwood is yet consumed in these cities. In the fall of 1938, it was estimated by the commissioners of Spokane County that 25,000 cords of wood would be required during the ensuing winter to meet relief needs alone.

It is not at all unlikely that these decreases will have been offset by a greater need for fuel in the small towns and rural areas resulting from the marked increase in population during the past several years. Thus, the outlook for the immediate future is for a fuelwood use in the Inland Empire equal to or slightly less than the 1934 figure. In Eastern Montana 1934 was probably a fairly representative year.

THERE ARE 338 THOUSAND MILES OF FENCE IN THIS REGION - ENOUGH TO REACH 13.5 TIMES AROUND THE EARTH AT THE EQUATOR. 7.8 MILLION POSTS ARE USED YEARLY TO MAINTAIN THIS FENCE.

CONSUMPTION OF FENCEPOSTS AND FENCE POLES BY ALL AGENCIES

The farm fence, as much a part of American agriculture as the barn, winds endlessly through the region, subdividing crop and pasture lands into countless small parcels. With three miles of fence needed for a single 160-acre tract the fencing on 63,970 farms, covering 48 million acres of land (1930 census), reaches the staggering total of 338,000[17/] miles and 87 million posts. Although the yearly consumption of the individual operator may vary from none to several thousand posts, to the average farmer the perennial task of replacing deteriorated fenceposts requires the use of approximately 122 new wooden posts yearly. For the agricultural industry as a whole, 7,800,000 fenceposts, representing nearly 8 million cubic feet of timber, are required each year to maintain the entire 338,000 miles.

Although wire fence is the most common form, the "buckpole" fence is used extensively in certain portions of the region. It is estimated that 887,000 fence poles are annually consumed for this buckpole fence and for corrals. The annual consumption of wooden fenceposts and fence poles is shown in table 20 on the following page.

The number of posts annually used per acre in maintaining fences varies in the several farming sections of the region depending upon four principal factors: the average size of the farms, the kind of fence, the spacing of the posts, and the life of these posts.

In figure 27 the relationship between farm area and the rods of fence per acre is shown graphically, based on data covering 1,693 farms in Montana, Idaho, and Northeastern Washington.

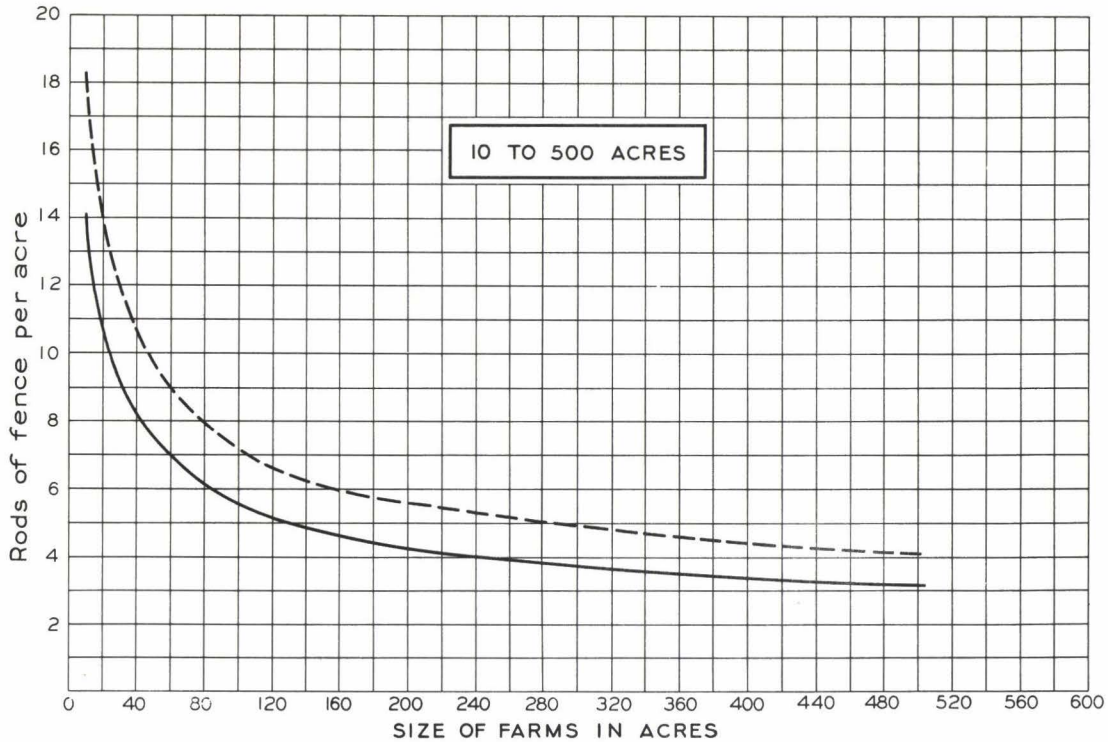
17/ This does not include the mileage in nonagricultural areas. However, for the purpose of estimating wood requirements this fence may be disregarded, being relatively small when compared with the great mileage on agricultural lands.

If in all farms the fields were of the same acreage and shape, it would be expected that the rods of fence per acre would always be the same regardless of size of farm. However, the more intensive management possible on small establishments has resulted in a finer subdivision than in the case of the large ranch and therefore a greater length of fence per acre. For example, the operator of a 40-acre place ordinarily owns a little over one mile of fence or 8.2 rods per acre, while the average 1,000-acre farm has about 7.3 miles of fence, but only 2.35 rods per acre. This factor results in a considerable difference in the rods of fence per acre of farm land for the Inland Empire and Eastern Montana. In the former the average farm is 281 acres in size whereas the average establishment in Eastern Montana contains 1,026 acres (1930 census). The above figures on rods of fence per farm include only the "net fence," which is the amount theoretically maintained by each farmer (his road and cross fence plus one-half of the party fence forming the division between his and adjoining farms). The total amount of fence needed to partition properties of various sizes, including all of that used jointly with neighboring establishments, is shown in figure 27 being designated as "gross fence." Approximately 46 percent of the "gross fence" on the average farm is line fence.

Table 20. - Average annual consumption of wooden fenceposts and fence poles in the Northern Rocky Mountain Region

	Thousand pieces	Thousand cubic feet
Fenceposts		
Eastern Montana	5,469	5,165
Western Montana	970	1,048
Northern Idaho	837	904
Northeastern Washington	556	600
Total	7,832	7,717
Fence poles		
Eastern Montana	887	887
Grand total poles and posts	8,719	8,604

RODS OF FENCE PER FARM ACRE NORTHERN ROCKY MOUNTAIN REGION



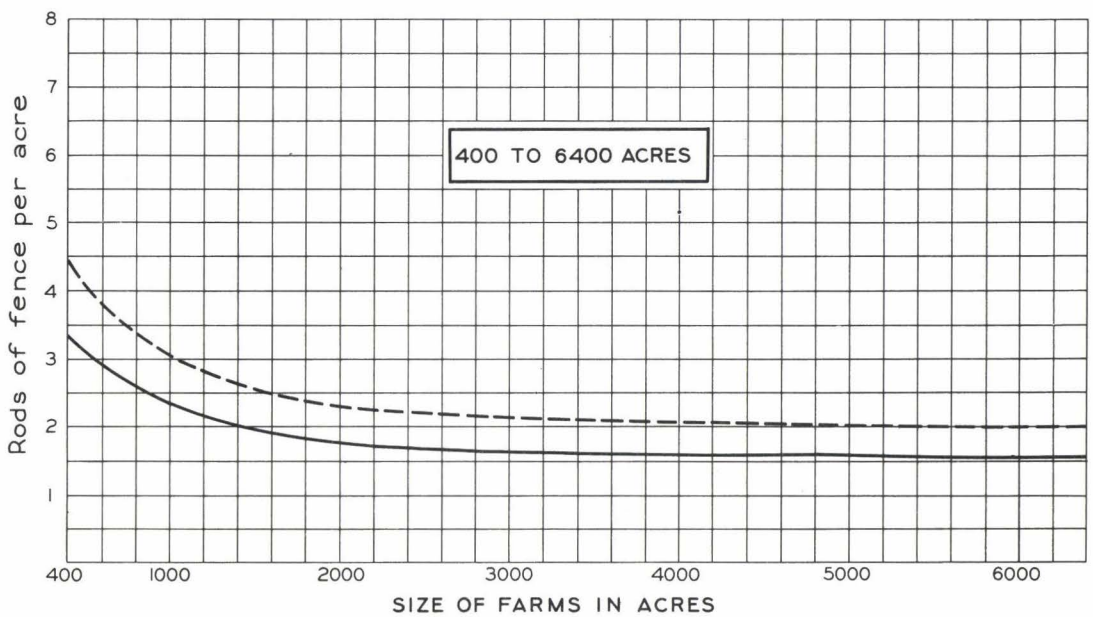


FIGURE 27

Utility and economy figure largely in the span distance between posts. West of the Continental Divide one rod is the most common spacing used, although both shorter and longer spans are to be found. In those farming sections of eastern Montana where posts are not so available, the interval is often stretched to two rods for economy's sake. However, for Eastern Montana as a whole the spacing between posts is estimated to average around 20 feet. Herd laws in a number of wheat counties in this part of the region make it the responsibility of the livestock owner to see that his cattle or other animals are confined; consequently, a number of grain farmers have removed practically all of their fence to eliminate the expense of maintenance and also because fence rows form ideal breeding spots for grasshoppers and other insect pests.

Almost all species of timber have been used to some extent for fenceposts. However, the bulk of the posts in the Inland Empire have been cedar, Douglas fir, larch, ponderosa pine, and lodgepole pine. Eastern Montana farmers prefer the several durable native species and the cedar posts imported from the Inland Empire, although practically all local species which are large enough to carry a staple are used.

The different species vary widely in their durability in direct contact with the soil. There is, moreover, a considerable variation in the average service life of individual species in different localities, depending upon several factors. West of the Continental Divide, the cedar posts have an average useful life of about 11 years, but in Eastern Montana the average service is 15 years because many farmers turn the posts over and use them a second time. The ponderosa pine found in Western Montana, Northern Idaho, and Northeastern Washington has proved unsatisfactory as a post material, usually lasting no more than three years. East of the mountains the scrubby variety of the same tree, known to some as bull pine or pitch pine, by reason of its high resin content makes better posts which last about eight years. Occasional pitch pines may yet be found so saturated with resin that posts from them will last as long as 40 years. These, however, have become very scarce, having been sought by farmers for many years. While the ordinary larch post will last about eight years, posts from heavy butt logs have shown much greater resistance to decay. Post size juniper trees have become increasingly scarce in Eastern Montana as this species, like the best pitch pine, gives unusually long service.

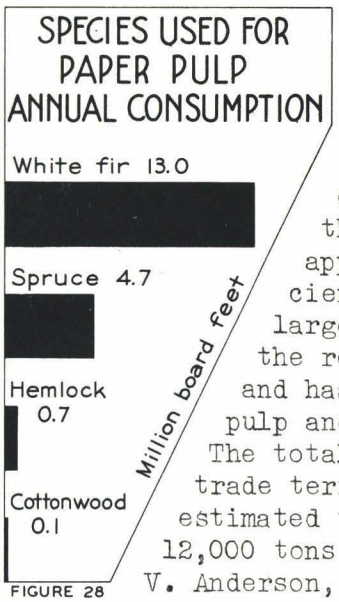


FIGURE 28

CONSUMPTION OF PULP LOGS BY THE PAPER INDUSTRY

Four species of wood are now manufactured into pulp in this region, namely, white fir, spruce, hemlock, and cottonwood. Recently compiled timber stand estimates place the total volume of these pulping species at approximately 24 billion board feet, a sufficient amount to maintain a pulp industry much larger than the present. The only pulp mill in the region is located on the outskirts of Spokane and has a capacity of 26,000 tons of ground wood pulp and 10,000 tons of sulphite pulp per year. The total paper requirements of the rather limited trade territory tributary to the Inland Empire are estimated to be about 40,000 tons of newsprint and 12,000 tons of wrapping paper yearly. According to I. V. Anderson, "...this paper plant has experienced difficulty in holding this market against the sharp competition of both west coast and eastern mills."18/ This fact and the freight differential to be overcome in meeting competition of better located plants for the eastern markets have, so far, discouraged the construction of other pulp mills in the Inland Empire where the bulk of the resource is located.

During the 11-year period from 1927 to 1937, inclusive, 18.5 million board feet of logs have been consumed annually in the Spokane pulp mill. These logs have been obtained from scattered sources in Northeastern Washington, Northern Idaho, and Western Montana. Approximately 70 percent of the log volume has been white fir, 25 percent spruce, and the remainder hemlock and cottonwood (table 21).

Table 21. - Average annual consumption of pulp logs 1925-1937, Northeastern Washington

Species	Thousand board feet log scale	Thousand cubic feet
Spruce	4,700	794
White fir	13,000	2,124
Hemlock	700	114
Cottonwood	100	15
Total	18,500	3,047

18/ I. V. Anderson - in unpublished statistics for Joint Congressional Committee Report, 1938.

APPENDIX

It should be understood that although these figures have necessarily been based on different periods for different items all the data fall within the period 1925-1937 and for the most part the averages obtained are fairly representative of that period.

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Table A. - AVERAGE ANNUAL CONSUMPTION OF ALL TIMBER PRODUCTS[1] IN THE NORTHERN ROCKY MOUNTAIN REGION

Item	Eastern Montana	Western Montana	Northern Idaho	Northeastern Washington	Total
	- - - - - - - Thousand cubic feet[2] - - - - - - -				
Lumber[3]	9,873	8,338	8,501	16,105	42,817
Fuelwood					
Green-cut	14,027	8,058	15,067	16,306	53,458
Slabs, scraps, & dead-cut	19,745	17,837	14,104	3,741	55,427
Total	33,772	25,895	29,171	20,047	108,885
Fenceposts and fence poles					
Green-cut	4,991	877	648	370	6,886
Dead-cut	1,061	171	256	230	1,718
Total	6,052	1,048	904	600	8,604
Mine timbers	540	2,296	1,331	54	4,221
Converter poles	87	151	--	--	238
Poles	327	138	142	97	704
Piling	208	45	59	35	347
Stubs	25	9	9	9	52
Hewed ties	154	137	56	217	564
Pulp logs[4]	--	--	--	3,570	3,570
House logs	332	71	95	71	569
Shingles	442	212	205	237	1,096
Total	51,812	38,340	40,473	41,042	171,667

1/ Not including the abnormal consumption at Fort Peck Dam where a large volume of timber products was consumed between 1933 and 1938.
2/ The actual cubic content of the products consumed.
3/ Boards, plank, timbers, and sawed ties.
4/ Includes 523,000 cubic feet used in manufacture of fireproof wall covering by the mining industry.

Table B. - AVERAGE ANNUAL CONSUMPTION OF LUMBER[1] IN THE NORTHERN ROCKY MOUNTAIN REGION

Kind of user or use	Eastern Montana	Western Montana	Northern Idaho	Northeastern Washington	Total
	- - - - Thousand board feet (lumber tally) - - - -				
Remanufacturing industries[2]	48	25,193	49,790	159,730	234,761
Railroads	47,026	14,819	13,088	8,284	83,217
Farms	39,360	10,370	13,730	10,230	73,690
Mining industry	3,744	38,821	15,760	688	59,013
Nonfarm construction	15,778	6,003	5,743	12,130	39,654
State and county highways	11,386	2,040	2,715	1,741	17,882
Federal agencies[3]	780	1,670	1,120	350	3,920
Public utilities	329	1,157	86	79	1,651
Total	118,451	100,073	102,032	193,232	513,788

1/ Boards, plank, timbers, and sawed ties.
2/ There is a small but unavoidable amount of duplication due to millwork items which are included in some of the other headings.
3/ This does not include the abnormal consumption at the Fort Peck Dam where a large volume of timber products was consumed between 1933 and 1938.

Table C. - AVERAGE ANNUAL PER CAPITA CONSUMPTION OF LUMBER[1] BY TYPE OF CONSUMPTION

Kind of use or user	Eastern Montana	Western Montana	Northern Idaho	Northeastern Washington	Northern Rocky Mountain Region
	- - - - - Board feet (lumber tally) - - - - - - - -				
Remanufacturing industries	--	160	415	907	281
Railroads	124	94	109	47	100
Farms	104	66	115	58	88
Mining industry	10	246	131	4	71
Nonfarm construction	41	38	48	69	48
State & county highways	30	13	23	10	21
Federal agencies[2]	2	11	9	2	5
Public utilities	1	7	1	--	2
Total	312	635	851	1,097	616

1/ Boards, plank, timbers, and sawed ties.
2/ This does not include the abnormal consumption at Fort Peck where a large volume of timber products was consumed between 1933 and 1938.

Table D. - LUMBER USED[1] BY REMANUFACTURING INDUSTRIES IN THE NORTHERN ROCKY MOUNTAIN REGION 1928 AND 1933

Item	Year and species																	Average 1928-1933
	1928									1933								
	Cedar	Douglas fir	Larch	Ponderosa pine	White fir	White pine	Spruce	Hard-woods	Total	Cedar	Douglas fir	Larch	Ponderosa pine	White fir	White pine	Spruce	Hard-woods	Total	All species
	Thousand board feet - lumber tally																	
EASTERN MONTANA																		
Sash, frames, doors, general millwork											8		81				7	96	48
WESTERN MONTANA																		
Sash, frames, doors, general millwork		4,890	4,100	22,892		805	200	24	32,911		4		3,742					3,746	18,328
Boxes and crates[2]				5,345					5,345		1	1	3,661		500	154		4,317	4,831
Miscellaneous[3]		7		4,000	10	8		35	4,060						[5] 8			8	2,034
Total		4,897	4,100	32,237	10	813	200	59	42,316		5	1	7,403		508	154		8,071	25,193
NORTHERN IDAHO																		
Sash, frames, doors, general millwork	16	9	2	36,151	1	33,504			69,683										34,842
Boxes and crates[2]		1,565	15	8,959	60	5,514	1,035		17,148				8,629		4,017		1	12,647	14,898
Miscellaneous[3]				51					51		50							50	50
Total	16	1,574	17	45,161	61	39,018	1,035		86,882		50		8,629		4,017		1	12,697	49,790
NORTHEASTERN WASHINGTON																		
Caskets	1,057					65			1,122	440					75			515	819
Sash, frames, doors, general millwork	35	383	300	76,864	35	10,832	35	263	88,747		192	1	22,871		1,800		3	24,867	56,807
Boxes and crates[2]				46,661	500	1,000	3,850		52,011	60			23,313	1,069	205	451	218	25,316	38,663
Match blocks						63,148			63,148						[4]			[4]	63,148
Miscellaneous[3]		70		298		4	2	64	438		93		16		3		36	148	293
Total	1,092	453	300	123,823	535	75,049	3,887	327	205,466	500	285	1	46,200	1,069	2,083	451	257	50,846	159,730
TOTAL NORTHERN ROCKY MOUNTAIN REGION																		
Caskets	1,057					65			1,122	440					75			515	819
Sash, frames, doors, general millwork	51	5,282	4,402	135,907	36	45,141	235	287	191,341		204	1	26,694		1,800		10	28,709	110,025
Boxes and crates[2]		1,565	15	60,965	560	6,514	4,885		74,504	60	1	1	35,603	1,069	4,722	605	219	42,280	58,392
Match blocks						63,148			63,148						[4]			[4]	63,148
Miscellaneous[3]		77		4,349	10	12	2	99	4,549		143		16		11		36	206	2,377
Total	1,108	6,924	4,417	201,221	606	114,880	5,122	386	334,664	500	348	2	62,313	1,069	6,608	605	265	71,710	234,761

1/ From special canvasses by the Forest Service and the Bureau of Census.
2/ A small amount of wood used by nonremanufacturing industries for boxes and crates included in 1933, but not included in 1928.
3/ Auto bodies, furniture, store fixtures, boats, etc.
4/ No record obtained in 1933.
5/ Sugar pine.

Table E. - AVERAGE ANNUAL CONSUMPTION OF CROSSTIES, TIMBERS, BOARDS, PLANK, AND PILING BY RAILROADS IN THE NORTHERN ROCKY MOUNTAIN REGION 1/

Item	Units	No.	Board feet (lumber tally)	Cubic feet
		- - - - - - - Thousands - - - - - - -		
EASTERN MONTANA				
Sawed crossties	Pieces	932	37,280	3,107
Hewed crossties	Pieces	44		154
Sawed timbers, boards, plank			9,746	812
Piling	Linear ft.	65		49
Total				4,122
WESTERN MONTANA				
Sawed crossties	Pieces	281	11,240	937
Hewed crossties	Pieces	39		137
Sawed timbers, boards, plank			3,579	298
Piling	Linear ft.	23		18
Total				1,390
NORTHERN IDAHO				
Sawed crossties	Pieces	262	10,480	873
Hewed crossties	Pieces	16		56
Sawed timbers, boards, plank			2,608	217
Piling	Linear ft.	21		16
Total				1,162
NORTHEASTERN WASHINGTON				
Sawed crossties	Pieces	123	4,920	410
Hewed crossties	Pieces	62		217
Sawed timbers, boards, plank			3,364	281
Piling	Linear ft.	15		11
Total				919
TOTAL REGION				
Sawed crossties	Pieces	1598	63,920	5,327
Hewed crossties	Pieces	161		564
Sawed timbers, boards, plank			19,297	1,608
Piling	Linear ft.	124		94
Total				7,593

1/ Although consumption data were not available for all railroads for the same period, these figures, for the most part, are representative for the period 1925-1937.

Table F. - AVERAGE ANNUAL CONSUMPTION OF NEW LUMBER, SHINGLES, AND BUILDING LOGS ON FARMS, 1925-1934, INCLUSIVE

Item	Eastern Montana	Western Montana	Northern Idaho	Northeastern Washington	Total
	- - - - - - - - - - Thousands - - - - - - - - - -				
LUMBER[1]					
Board feet lumber tally	39,360	10,370	13,730	10,230	73,690
Cubic feet	3,280	864	1,144	853	6,141
SHINGLES					
Squares	35	13	17	13	78
Cubic feet	245	91	119	91	546
BUILDING LOGS					
Board feet lumber tally	2,780	600	800	590	4,770
Board feet log scale	2,060	440	590	440	3,530
Cubic feet	332	71	95	71	569
TOTAL CUBIC FEET	3,857	1,026	1,358	1,015	7,256
AVERAGE PER FARM					
Board feet lumber tally, lumber, shingles, logs	1.1	1.8	1.8	1.6	

1/ Rough and finished, including windows and doors.

Table G. - TIMBER PRODUCTS REQUIRED, PER THOUSAND CUBIC FEET OF GROSS VOLUME, IN THE CONSTRUCTION OF HOUSES, BARNS, AND SHEDS 1/

Item	Houses		Barns		Sheds	
	Frame	Log	Frame	Log	Frame	Log
	- - - - - Board feet lumber tally - - - - - -					
Rough & finished lumber	1,025	764	392	287	716	82
Shingles	88	88	49	49	53	53
Windows & doors[2]	49	49	--	--	--	--
Total	1,162	901	441	336	769	135
Logs[3]	--	460	--	277	--	1,275
Grand total	1,162	1,361	441	613	769	1,410

1/ Gross cubic volume taken from the top of foundation and not including basements (used in computing farm consumption).

2/ Not separated from lumber for barns and sheds.

3/ Thirty-five percent overrun from log scale to lumber tally assumed.

Table H. - AVERAGE ANNUAL CONSUMPTION OF LUMBER,[1] ROUND MINE TIMBERS, CONVERTER POLES, AND LOGS BY THE MINERAL INDUSTRY

Kind of mining	Product	Units	Board feet (lumber tally)	Cubic feet
		- - - - - - In thousands - - - - - -		
	EASTERN MONTANA			
Metal[2]	Round mine timbers	Lin. ft. 900		180
	Converter poles	Pcs. 6		87
	Lumber		3,330	278
Coal[3]	Round mine timbers	Lin. ft. 1,657		360
	Lumber		414	35
				940
	WESTERN MONTANA			
Metal[2]	Round mine timbers	Lin. ft. 4,561[6]		2,296
	Converter poles	Pcs. 41		151
	Lumber		38,821	3,235
				5,682
	NORTHERN IDAHO			
Metal[2]	Round mine timbers	Lin. ft. 2,017[7]		1,331
	Lumber		15,760	1,313
				2,644
	NORTHEASTERN WASHINGTON			
Metal[4]	Round mine timbers	Lin. ft. 73		48
	Lumber		570	48
Nonmetal[5]	Round mine timbers	Lin. ft. 8		6
	Logs	Bd. ft. log scale 3,250		523
	Lumber		118	10
				635

1/ Includes sawed mine timbers, boards, and plank.
2/ 1925-1937 inclusive.
3/ 1926-1936 inclusive.
4/ 1931-1937 inclusvie.
5/ 1938
6/ Eleven and four-tenths million board feet, log scale.
7/ Seven and four-tenths million board feet, log scale.

Table I. - ANNUAL CONSUMPTION OF LUMBER AND SHINGLES FOR NONFARM CONSTRUCTION, 1929

	Eastern Montana	Western Montana	Northern Idaho	Northeastern Washington	Total
	LUMBER - thousand board feet lumber tally				
URBAN BUILDINGS					
New construction					
Residential	6,155	1,739	2,325	5,087	15,306
Nonresidential	5,197	1,916	1,432	3,187	11,732
Additions, alterations, and repairs	1,423	846	603	2,790	5,662
Total	12,775	4,501	4,360	11,064	32,700
RURAL NONFARM BUILDINGS					
New construction					
Residential	1,550	750	725	475	3,500
Nonresidential	247	119	115	76	557
Additions, alterations, and repairs	1,030	496	486	315	2,327
Total	2,827	1,365	1,326	866	6,384
MUNICIPAL GOVERNMENTS	176	137	57	200	570
Grand total lumber	15,778	6,003	5,743	12,130	39,654
	SHINGLES - thousand squares				
URBAN BUILDINGS					
Residential and nonresidential (new construction)	5.1	1.5	2.2	4.5	13.3
Additions, alterations, and repairs	9.0	8.8	3.3	12.1	33.2
Total	14.1	10.3	5.5	16.6	46.5
RURAL NONFARM BUILDINGS					
Residential and nonresidential (new construction)	1.5	0.7	0.7	0.5	3.4
Additions, alterations, and repairs	12.6	6.3	6.1	3.7	28.7
Total	14.1	7.0	6.8	4.2	32.1
Grand total shingles	28.2	17.3	12.3	20.8	78.6
	LUMBER AND SHINGLES - thousand cubic feet				
Lumber	1,315	500	479	1,011	3,305
Shingles	197	121	86	146	550
Total	1,512	621	565	1,157	3,855

Table J. - AVERAGE ANNUAL CONSUMPTION[1] OF TIMBER PRODUCTS IN THE CONSTRUCTION AND MAINTENANCE OF STATE AND COUNTY ROADS

	Lumber[2]		Piling		Total
	M board feet lumber tally	M cubic feet	M linear feet	M cubic feet	M cubic feet
EASTERN MONTANA					
State highway construction	4,557		75		
State highway maintenance	369		11		
County roads	6,460		123		
Total	11,386	949	209	159	1,108
WESTERN MONTANA					
State highway construction	1,341		22		
State highway maintenance	163		3		
County roads	536		10		
Total	2,040	170	35	27	197
NORTHERN IDAHO					
State highways	1,679		37		
County roads	1,036		20		
Total	2,715	226	57	43	269
NORTHEASTERN WASHINGTON					
State highways	1,382		25		
County roads	359		7		
Total	1,741	145	32	24	169
Grand total	17,882	1,490	333	253	1,743

1/ The above data are based on the following periods: county roads 1937, State highways - Montana 1931-1936, Idaho 1936-1937, Washington 1935-1937.

2/ Boards, plank, timbers, and other sawed materials.

Table K. - AVERAGE ANNUAL[1/] CONSUMPTION OF FOREST PRODUCTS BY PUBLIC UTILITIES [2/]

Item	Pieces	Board feet lumber tally	Cubic feet
		- - - - - - - Thousands - - - - - - -	
		EASTERN MONTANA	
Poles	29,250		327
Stubs (round)	4,230		25
Stubs (sawed)	350	36	3
Crossarms	29,670	293	25
Total			380
		WESTERN MONTANA	
Poles	11,420		138
Stubs (round)	1,600		9
Stubs (sawed)	540	56	5
Crossarms	10,650	101	8
Other lumber		1,000	83
Total			243
		NORTHERN IDAHO	
Poles	12,030		142
Stubs (round)	1,513		9
Stubs (sawed)	80	9	1
Crossarms	7,802	77	6
Total			158
		NORTHEASTERN WASHINGTON	
Poles	6,085		97
Stubs (round)	1,430		9
Stubs (sawed)	120	12	1
Crossarms	6,517	67	6
Total			113
		NORTHERN ROCKY MOUNTAIN REGION	
Poles	58,785		704
Stubs (round)	8,773		52
Stubs (sawed)	1,090	113	10
Crossarms	54,639	538	45
Other lumber		1,000	83
Grand total			894

1/ Estimates largely based on renewal of products now in use according to the years of service expected.

2/ Electric, telephone, and telegraph systems including those owned by the Federal Government and the railroads.

Table L. - SIGNIFICANT STATISTICS RELATING TO TIMBER PRODUCT CONSUMPTION

	Eastern Montana	Western Montana	Northern Idaho	Northeastern Washington	Poles per mile
	- - - - - - - - - - Miles - - - - - - - - - -				
Farm fencing	275,000	23,000	24,000	16,000	
State highways	3,989	1,115	1,282	536	
County roads	52,100	4,321	8,353	2,895	
Milwaukee Railroad - track	1,197	373	300	208	
Northern Pacific Railway - track	1,527	839	469	200	
Great Northern Railway - track	2,069	379	163	355	
All other railroads - track	466	213	338	175	
Railroad telegraph and telephone lines	3,608	1,286	930	536	35
Railroad electric transmission lines	152	237	34	58	18
Railroad trolley lines	171	266	36	58	54
Commercial power companies	5,399	1,424	1,073	1,278	19
Rural electrification lines	886	522	1,092	681	15
Telegraph and large telephone companies	5,140	1,880	1,320	1,255	31
Shorter private telephone systems	2,330	370	910	135	30
Federally owned telephone line on poles	1,731	1,277	1,241	211	35